OPERATION & AFTERCARE MANUAL

MPF24 Extruder

Baker Perkins Ltd.
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USER NOTES

Contents Links

1 MPF24 Extruder

Note

Baker Perkins has a policy of continuous development and improvement of documentation and any comments you may have will be welcome.

Contact

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Note

Baker Perkins operation manuals are designed as "on-screen" electronic format documents. The printed version has the same content, but not the interactive cross link functions to aid quick reference to related information.

1.1 Operation Manual History

Rev.0	C.Goodacre	Original Documentation Language: English (UK)	08/04/2016
Rev. No.	**Author**	**Details**	**Date**

This Manual belongs to:

2 EC Machinery Directive

EC MACHINERY DECLARATION OF CONFORMITY OR INCORPORATION

(Directive 2006/42/EC and 2004/108/EC)

We hereby certify that the machinery detailed below, has been designed and manufactured to comply with all the relevant provisions of the EC Machinery Directive, as amended and the National Laws and Regulations adopting this Directive.

Machine description:	MPF24 Extruder with integrated Product Cutter
Machine number:	SF15125-7221-KP
Manufacturer:	Baker Perkins Ltd
Address:	Manor Drive Paston Parkway Peterborough PE4 7AP ENGLAND

For EC contracts, an original certificate for this machine is retained in the technical construction file at the above address and may be requested by the end user.

Date: April 2016

For machinery supplied to countries inside the EU the information on this page is applicable, however, we do not create specific contract documents for non-EU machines.

Certificates of Conformity - EC Plant Installations

All Baker Perkins machinery has been designed and constructed to meet the Health & Safety requirements covered under EEC directives.

However, as not all of the equipment in a final installation of a plant may be supplied by Baker Perkins, under the supply of machinery (Safety Regulations 1993) Baker Perkins would issue "A Declaration of Incorporation" to cover the supply of all Baker Perkins machines (including any merchanted equipment).

You should be aware that under the above regulations, it would be your responsibility to arrange for "A Declaration of Conformity" to be issued for the final plant installation comprising the equipment supplied by Baker Perkins *plus* all equipment supplied by others.

The installed plant will not in its entirety comply with the Supply of Machinery Regulations until this declaration of conformity has been issued.

Declarations of Incorporation

When a machine has been supplied with "A Declaration of Incorporation" it should be noted that residual hazards in addition to those detailed in the Hazard Section of this manual may exist or be created at installation by an end user. Please contact Baker Perkins for advise if required.

ATEX Directive

It is the customer's responsibility to define the probability of the existence of an explosive dust atmosphere in each area of the plant where unit machines are to be sited - zone 20, 21, 22, or unclassified. The equipment in this manual has been supplied on the basis of it being sited in an unclassified area. Should the zone identification change, the equipment would need to be modified so suit the new zone classification by the end user.

3 MPF24 Extruder Specification

3.1 Intended Use

- Suitable for feeding, mixing/cooking, of cereal formulations up to nominal 70kg/hr.

3.2 Contract Reference Number

- SF15125

3.3 Machine Number

This Manual covers the following equipment -

- 7221 - MPF24 Extruder
  (Extruder with integrated Product Cutter & Control Panel)

3.4 Noise Level

CAUTION *The MPF24 Extruder operates with a noise level of 80dBA or below, measured at 1 metre from the equipment. The noise level for this machine should be measured and recorded by the customer after final installation and commissioning (this is mandatory under CE Regulations). Baker Perkins advise ear protection to be worn where noise levels exceed 80 dB(A) to comply with EC Regulations.*

3.5 Electrical Power Supply

	Voltage	Phase	Cycles	Neutral
Power	480 +/- 10%	3	60 +/- 2%	Yes
Control	24v DC	-	-	-

CAUTION *Some panel components may operate at a high voltage.*

- Main Drive - 5.5kw
- Barrel Heating - 0.8kw
- Cutter - 0.55kw
- Feeder - 0.37kw
- Feed Pumps - 0.5kw
- Barrel Cooling Unit - 2.0kw.

3.6 Dimensions & Weight

- L = 2442mm, W = 1119mm, H = 2360mm.
- Weight = 1000kg.

3.7 Other Details

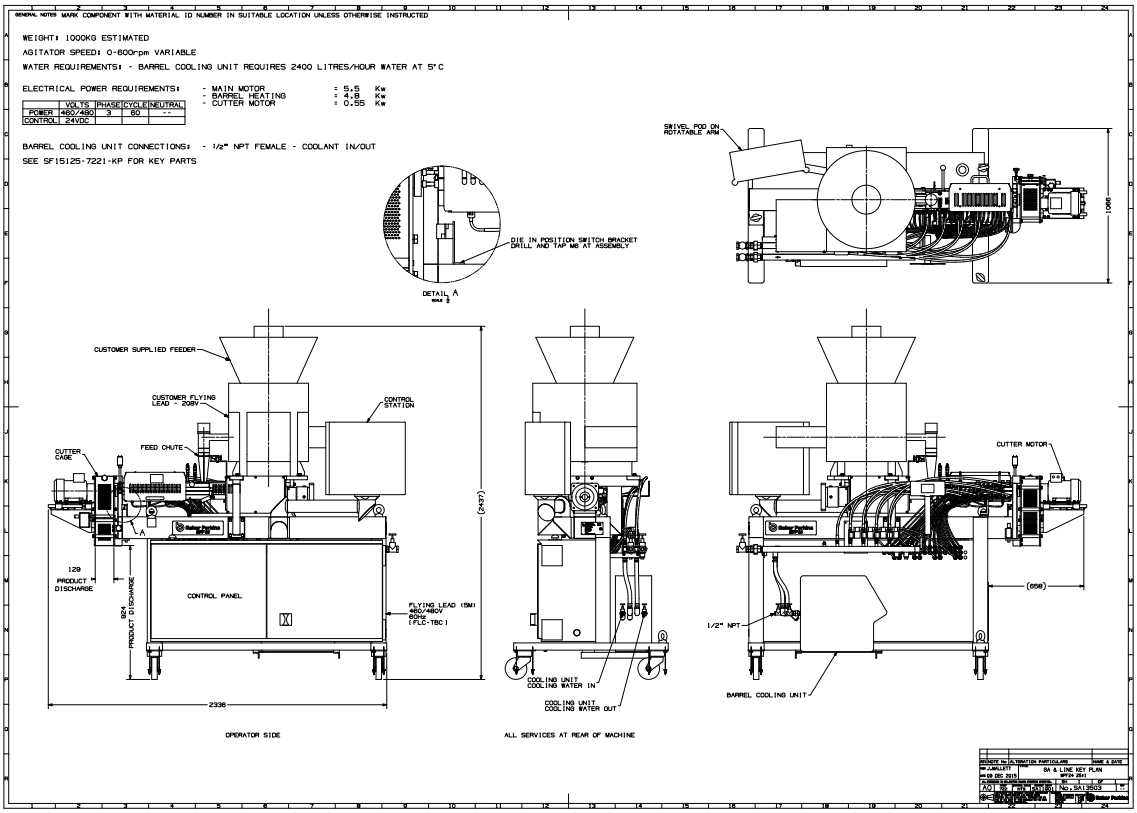
- Refer also to Key Layout drawing SL10741 in the BOM section.
- If pneumatic components are fitted to the machine, a filtered air supply at 5.5 bar (80 psi) will be required.

Water Supply

Barrel (manifold) requires 1600 lt/hr maximum at 15°C and 4 bar.

Barrel Cooling Unit requires 2400 lt/hr chilled water at 5ºC and 4 bar.

3.8 Dimension



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3.9 Full Specification Details

MPF24 Twin Screw Extruder is fitted with an integrated Product Cutter. The machine is supplied product by a "Feeder" unit (Customer or optional Baker Perkins supply).

Extruder

5.5kW @ 600rpm variable speed servo drive.

One piece horizontally split clamshell barrel, nominal barrel length 25:1 L/D.

One piece barrel liner manufactured from through hardened steel.

24mm liner bore diameter.

Barrel water-cooled via cored one-piece barrel liner backing block.

Barrel electrically heated via cartridge type heaters.

Extruder barrel electroless nickel plated for corrosion resistance.

Co-rotating, self wiping fully segmented agitator assemblies.

Die Assembly: Single insert holder.

Two-tank liquid feed system with inverter driven peristaltic pumps.

Product cutter with inverter driven rigid blade knife.

One free standing barrel cooling unit.

One Allen Bradley PLC based control panel with touch screen Operator Interface Terminal (UL approved).

Water Connections

- 1/2" NPT Female - cooled water in
- 1/2" NPT Female - cooled water out

Product Cutter

The extruder is fitted with an integrated Product Cutter. Fitted safety interlocks allow the cutter to be swung open for cutter change or direct product extrusion.

General

Finish, two pack acrylic paint colour 'steelit' or self colour stainless steel. One toolkit is supplied. The machine conforms with Machinery Directive 98/37/EC and Electromagnetic Compatibility Directive 89/336/EEC.

Process Performance

This machine is required for R&D work in a lab environment. The contract is supply only and there is no product definition. The throughput will be between 5 & 20 Kg/Hr.

- Maximum Operating Temperature: 170°C
- Maximum Operating Pressure: 2000 psi
- Actual Barrel Length: 25:1

Barrel Zones Information

Zone	Function	Barrel Ports	Heating/Cooling
1	5.25:1 Feed	Round Feed Port	Water Cooled (Constant)
2	5:1 Process	-	Electrically Heated / Water Cooled
3	5:1 Process	-	Electrically Heated / Water Cooled
6	5:1 Process	-	Electrically Heated / Water Cooled
7	5:1 Process	-	Electrically Heated / Water Cooled

4 Safety

4.1 WARNINGS, Cautions, Notes and Hints

This manual highlights warnings, cautions, notes and tips as described below:-

WARNING THIS IDENTIFIES A HAZARD WHICH COULD LEAD TO PERSONAL INJURY. USUALLY AN INSTRUCTION WILL BE GIVEN, TOGETHER WITH A BRIEF EXPLANATION AND THE POSSIBLE RESULT OF IGNORING THE INSTRUCTION.

CAUTION *This identifies a hazard which could lead to damage to the equipment, damage to other equipment or environmental pollution. Usually an instruction will be given, together with a brief explanation and the possible result of ignoring the instruction.*

Note This highlights additional information which may be helpful, but where there are no special safety implications.

TIP This provides information and advice that may be useful when operating or maintaining the equipment.

4.2 Alternative Symbols

For the American market, different warning symbols may be used in addition to the symbols shown in the previous section.

Definitions for identifying the various hazard levels shown on safety labels are provided below with their respective signal words/symbols:

The use of this **red** symbol with the word "**DANGER**" signifies an immediate hazard with a high likelihood of severe personal injury or death if instructions, including recommended precautions, are not followed.

The use of this **orange** symbol with the word "**WARNING**" signifies the presence of hazards or unsafe practices which could result in severe personal injury or death, if instructions, including recommended precautions, are not followed.

The use of this **yellow** symbol with the word "**CAUTION**" signifies possible hazards or unsafe practices which could result in minor injury, product or property damage if instructions, including recommended precautions, are not followed.

4.3 General

This manual is intended to help you use the equipment safely and effectively. Baker Perkins equipment is designed to comply with relevant safety legislation, and includes safety features to help prevent injury or damage. However, all machines can be dangerous if misused.

WARNING

BEFORE ATTEMPTING TO USE THE EQUIPMENT DESCRIBED IN THIS MANUAL, YOU MUST READ, UNDERSTAND AND FOLLOW ALL THE SAFETY INFORMATION AND INSTRUCTIONS CONTAINED IN THE MANUAL.
FAILURE TO FOLLOW ALL THESE WARNINGS, CAUTIONS AND OPERATING INSTRUCTIONS COULD LEAD TO SERIOUS INJURY TO YOURSELF OR OTHERS OR TO DAMAGE OF THE EQUIPMENT.
IF THERE ARE ANY WARNINGS, CAUTIONS OR OPERATING INSTRUCTIONS THAT YOU DO NOT UNDERSTAND, DO NOT USE THE EQUIPMENT. CONTACT YOUR SUPERVISOR AND ARRANGE FOR PROPER TRAINING ON THE USE OF THE EQUIPMENT.
IF IN DOUBT - ASK!!!

WARNING

IT IS THE RESPONSIBILITY OF THE USER TO AUTHORISE PERSONNEL TO OPERATE OR MAINTAIN THE EQUIPMENT AND TO ENSURE THAT THOSE PERSONNEL HAVE RECEIVED TRAINING TO ENABLE THEM TO CARRY OUT THEIR WORK SAFELY AND EFFECTIVELY.

Keep these instructions available for use by all concerned with the operation and maintenance of the machine.

4.4 Purpose of use

WARNING

THIS EQUIPMENT IS ONLY TO BE USED FOR THE PURPOSE FOR WHICH IT WAS SPECIFICALLY DESIGNED.
ATTEMPTING TO USE THE EQUIPMENT FOR ANY OTHER PURPOSE MAY CAUSE INJURY OR DAMAGE.

This equipment has been designed for use in the food production industry and is specified to handle food materials. In no circumstances must any hard material, foreign object or substance be allowed to enter the processing equipment.

These instructions are written to support the equipment usage determined at the time of sale. If at any time there is a change in use of the equipment from the original specification, appropriate safe operating procedures must be established. It is strongly recommended that Baker Perkins is consulted both in the proposed new usage of the equipment and in developing the new instructions.

4.5 Electrical Lock Out and Tag Out of Isolator

A "main disconnect switch" is incorporated on all Baker Perkins equipment where complete electrical controls are provided by Baker Perkins The function of the main disconnect switch is to provide a means of disconnecting and locking out customer supplied electrical power from the equipment when performing set up, maintenance or cleaning services to the equipment. Electrical power is disconnected and locked out by placing the main disconnect switch in the OFF position and securing it in that position using a padlock. Electrical power can be re-connected by removing the padlock and placing the main disconnect switch in the ON position. A tag out procedure should be used to record and monitor lock outs.

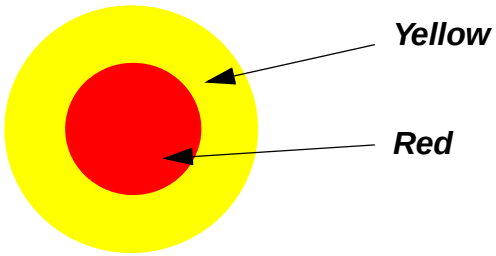
4.6 Emergency Shutdown

Before using the equipment, you must know how to shut it down in an emergency.

WARNING

DO NOT ATTEMPT TO USE THIS EQUIPMENT UNLESS YOU KNOW HOW TO SHUT IT DOWN IN AN EMERGENCY.
YOU MUST BE ABLE TO STOP THE EQUIPMENT QUICKLY IN AN EMERGENCY TO AVOID THE POTENTIAL DANGER OF SERIOUS INJURY TO YOURSELF OR OTHERS IN EMERGENCY SITUATIONS.

To stop the equipment in an emergency, press one of the red Emergency Stop pushbuttons located around the equipment. The following illustration shows an Emergency Stop pushbutton. These are often referred to as E-Stops.



These E-Stops are usually located at each main control panel and at various other positions around the equipment. It is your responsibility to familiarise yourself with the location and operation of the E-Stops on the equipment you are working on. When an E-Stop is pressed all movement stops as quickly as possible.

CAUTION

*Use the Emergency Stop only in the case of an **emergency** to equipment or personnel. The E-stop is very hard on the equipment **and it must not be used for routine stops.***

WARNING

DO NOT RESTART THE EQUIPMENT AFTER AN EMERGENCY STOP SHUTDOWN UNTIL THE REASON FOR THE EMERGENCY STOP IS CLEARLY UNDERSTOOD. NEVER RESTART THE EQUIPMENT UNTIL YOU ARE COMPLETELY SATISFIED THAT IT IS SAFE TO DO SO.

WARNING

MANY OF THE MACHINES THAT BAKER PERKINS BUILD USE "SAFE STOP" TECHNOLOGY ON INVERTER DRIVES. ENSURE THAT THE POWER SUPPLY TO THE MOTOR IS ISOLATED BEFORE REMOVING TERMINAL BOX COVERS OR WORKING ON MOTOR TERMINALS.

4.7 Guards and Safety Devices

Suitable guards and safety devices are incorporated in the design of all Baker Perkins equipment. The general principles followed in the design of the guards and safety devices follow those recommended by the standards relevant to the country of sale, for example

- the UK Health and Safety Executive and other relevant European and British Standards.
- The US Occupational Safety and Health Administration (OSHA) and other relevant United States standards.

Safety guards are provided on all Baker Perkins equipment where foreseeable potential hazards may be present to the operator or other personnel. The purpose of safety guards is to provide a physical barrier which will prevent the personnel from gaining access to hazardous areas on the equipment when the equipment is running. Two (2) types of safety guards are installed by Baker Perkins.

1 **Permanent Safety Guards:** Permanent safety guards are installed on the equipment using fasteners which cannot be removed without tools. Removal of these safety guards should only be required for maintenance purposes by qualified maintenance personnel. Always disconnect, lock out and tag out electrical power to the equipment before removing permanent safety guards. Always make sure that permanent safety guards are replaced and secured to the equipment using the same type of fasteners.

2 **Interlocked Safety Guards:** Safety guards which can be removed or lifted (without tools) to gain access for set up and/or cleaning purposes are policed by electrical interlocks. Removing or lifting a guard policed by an electrical interlock will interrupt electrical power to the equipment control circuits, disabling or shutting down all the equipment drives. Replacing the guard will restore electrical power to the equipment drive. For most machines it will be necessary to restart the drive by operating the start push-button.

WARNING THE ELECTRICAL INTERLOCKS OR INTERLOCKED SAFETY GUARDS MUST NOT BE TAMPERED WITH OR BY-PASSED IN ORDER TO RUN THE EQUIPMENT WITH THE CORRESPONDING SAFETY GUARD REMOVED OR LIFTED.

These protective features are tested as far as possible or practical at Baker Perkins before the equipment is dispatched. Further operational checks are carried out during commissioning.

WARNING THE COMPONENTS USED IN SAFETY SYSTEMS SHOULD NOT BE REPLACED BY ANY ALTERNATIVE, OR THE METHOD OF THEIR FUNCTION ALTERED IN ANY WAY. TO DO SO MAY COMPROMISE THE SAFE OPERATION OF THE EQUIPMENT AND CAUSE A DANGER OF INJURY OR DAMAGE

WARNING THE USER IS RESPONSIBLE FOR CARRYING OUT REGULAR INSPECTIONS TO VERIFY THE CORRECT OPERATION OF ALL SAFETY SYSTEMS.

WARNING WHEN THE EQUIPMENT IS IN OPERATION ALL SAFETY GUARDS AND SYSTEMS MUST BE PROPERLY IN PLACE AND OPERATIONAL.
ALL ELECTRICAL ENCLOSURE DOORS, NOT EQUIPPED WITH AUTOMATIC INTERLOCKS, MUST BE LOCKED TO PREVENT ACCESS BY UNAUTHORISED PERSONNEL.

Accidents can be prevented by following these safety precautions, and insisting that those working with you do the same.

4.8 Installation Safety Precautions

The engineer installing the equipment must ensure that all guards are secured in position and that the safety devices and systems are set to operate correctly before the equipment is put into use or handed over to the customer for production.

CAUTION *Customer's should not re-use the eye bolts supplied with Baker Perkins machines. The eye bolts should only be used to lift the machine they are supplied with.*

4.9 Commissioning Safety Precautions

1 Before starting equipment the moving parts must be checked for freedom of movement by rotating by hand where possible or practical. Where necessary, direction of rotation of drives must be confirmed before they are connected to 'direction of rotation sensitive' mechanisms.

2 Correct lubrication of the equipment must be checked before it is put into motion.

3 Before equipment is put into service its insulation resistance must be tested to detect any problems in the electrical system which may have occurred due to dampness or damage caused by transposition or storage.

4.10 Operation Safety Precautions

1 Before starting the equipment, especially after a shutdown during which cleaning or maintenance activities have taken place, inspect the equipment to ensure that it has been correctly assembled, all guards and safety systems are in place and that there are no signs of work still ongoing on the equipment. In particular inspect the equipment for any tools or other items which may have been left on or around it.

2 Prior to making the equipment operational, make sure that all maintenance or cleaning activities have been completed and that the "TAG OUT" and "LOCK OUT" procedures are carried out correctly. All "LOCK OUT" and "TAG OUT" tags must be removed by the person authorised to do so.

3 Always keep the area around the equipment clean and tidy. Obstructions can cause accidents. Clean up any spillages immediately.

4 Always be alert when operating the equipment. Your own actions are your best defence against the dangers of accidents and injury. Immediately investigate any signs of abnormal operation. If necessary, shut the equipment down until the cause of any abnormal operation is investigated by relevant qualified personnel.

5 All personnel not authorised to be within the operating zone should be warned and moved outside the operating zone prior to starting the equipment.

6 The equipment should always be run within the specified limits for speeds, pressures, temperatures, etc.

7 The equipment should always be attended while in operation. Keep alert and observe indicator lights and warnings that are displayed on the machine.

8 Do not place fingers, hands or any part of your body into the equipment or near moving parts when the equipment is not isolated from all power sources.

9 Stopping the equipment.

WARNING

WHEN STOPPING THE EQUIPMENT, KEEP CLEAR OF ANY MOVING PART. REMEMBER THAT ROTATING EQUIPMENT WILL CONTINUE MOVING FOR SOME PERIOD AFTER POWER HAS BEEN SHUT OFF. SERIOUS INJURY COULD RESULT IF A LIMB IS CAUGHT BY A MOVING PART.

WARNING

DO NOT STOP THE EQUIPMENT BY OPENING AN INTERLOCKED GUARD. THIS MAY EXPOSE YOU TO DANGEROUS MOVING PARTS. STOP THE EQUIPMENT FIRST, WAIT FOR IT TO COME TO REST, AND THEN OPEN THE GUARD.

10 Permanent Guards

WARNING

DO NOT ATTEMPT TO GAIN ACCESS TO THE MACHINE UNDER ANY CIRCUMSTANCES BY REMOVING A PERMANENT GUARD. THIS MAY EXPOSE YOU TO THE DANGER OR SERIOUS INJURY.

Permanent guards are often secured by fasteners or bolts which require the use of hand tools in order to remove them. This means that only a “responsible” person may remove them, and this person must take responsibility for safety in this situation.

In the majority of cases this will mean that the machine must be isolated and the “LOCK OUT” and “TAG OUT” procedures are followed. When this is not the case refer to the section “Running the equipment without safety systems”.

11 All air, hydraulic and electrical power must be disconnected and when the machine is not in use.

12 This equipment requires proper periodic preventive maintenance to keep it working at peak performance. You must be satisfied that periodic preventive maintenance has been carried out before you operate the equipment.

WARNING

IF YOU ARE NOT SATISFIED THAT PREVENTIVE MAINTENANCE HAS BEEN CARRIED OUT AND THAT THE EQUIPMENT IS IN A SAFE CONDITION, DO NOT USE IT.
CONTACT YOUR SUPERVISOR.
OPERATING EQUIPMENT WHICH HAS NOT BEEN MAINTAINED PROPERLY COULD LEAD TO SERIOUS PERSONAL INJURY.

13 Faulty equipment.

WARNING

IF YOU HAVE ANY REASON TO THINK THAT THE EQUIPMENT IS OPERATING DANGEROUSLY, STOP IT (USING THE E-STOP IF NECESSARY).
INFORM YOUR SUPERVISOR.
CONTINUING TO OPERATE EQUIPMENT WHICH YOU BELIEVE MIGHT BE DANGEROUS COULD LEAD TO SERIOUS PERSONAL INJURY.

CAUTION

If you have any reason to think that the equipment is operating below its usual standard or abnormally in any way, you must report this to your Supervisor as soon as possible.
Continuing to use equipment which you believe is operating below standard could lead to damage to the equipment or other equipment and adversely affect the products.
Be especially aware of unusual noises or vibrations.

14 For equipment with programmable logic controls, do not attempt to re-program or alter the programming established by Baker Perkins unless approved and supervised by qualified Baker Perkins personnel. Any attempt to do this could result in damage to the equipment and may create unsafe operating conditions on the equipment.

4.11 Cleaning and Maintenance Safety Precautions

Lock Out/Tag Out Procedures

The user is responsible for ensuring that safe procedures are in place for isolation of the equipment, and that these procedures are used before any cleaning or maintenance tasks are commenced. All power sources should be locked out and tagged indicating by who, for what and why the power has been removed.

WARNING

BEFORE ATTEMPTING CLEANING OR MAINTENANCE OF ANY DESCRIPTION ON THE EQUIPMENT ENSURE THAT IT IS ISOLATED FROM ALL POWER SOURCES:-
- ELECTRICAL SUPPLY.
- PNEUMATIC SUPPLY.
- HYDRAULIC SUPPLY.

ENSURE THAT THE LOCK OUT PROCEDURES HAVE BEEN APPLIED.
ENSURE THAT ANY EQUIPMENT WHICH OPERATES AT ELEVATED TEMPERATURES HAS COOLED TO A SAFE WORKING TEMPERATURE BEFORE STARTING WORK.
FAILURE TO CARRY OUT THESE INSTRUCTIONS COULD RESULT IN SERIOUS INJURY.

WARNING

UPON COMPLETION OF ANY CLEANING OR MAINTENANCE ACTIVITIES ENSURE THAT ALL PERSONNEL ARE CLEAR OF THE MACHINE, COMPONENTS ARE CORRECTLY ASSEMBLED AND THE EQUIPMENT IS SAFE TO OPERATE. DO NOT RUN THE EQUIPMENT UNLESS ALL GUARDS ARE SECURELY FITTED IN THEIR CORRECT POSITION. IF PARTS ARE NOT CORRECTLY INSTALLED, OR GUARDS ARE NOT FITTED PROPERLY, SERIOUS INJURY CAN RESULT.
TEST ANY SAFETY SYSTEMS BEFORE PUTTING THE EQUIPMENT BACK INTO PRODUCTION.

WARNING LOCK ALL ELECTRICAL ENCLOSURES THAT DO NOT HAVE SAFETY INTERLOCKS SUCH THAT ACCESS TO THEM IS BY AUTHORISED PERSONNEL ONLY.

Carefully check that all screws, bolts, nuts and other fixings are securely replaced.

CAUTION *After any parts have been reset or replaced, the equipment should be turned over by hand, if possible or practical, before applying power. This prevents serious damage occurring to the equipment if parts have been incorrectly fitted or set.*

WARNING BEFORE TURNING OVER EQUIPMENT BY HAND, CAREFULLY ANALYSE THE HAZARDS WHICH MAY BE CREATED BY THIS ACTIVITY AND TAKE ALL NECESSARY PRECAUTIONS TO MINIMISE THE RISK OF INJURY TO YOURSELF OR TO OTHERS.

Compressed Air

Some cleaning and maintenance operations involve the use of compressed air. Treat compressed air with respect, it can be dangerous if misused. The user is responsible for issuing guidelines for the safe use of compressed air.

WARNING COMPRESSED AIR MOVES PARTICLES THAT CAN CAUSE SERIOUS EYE INJURIES. ALWAYS WEAR PROPER EYE PROTECTION AND DO NOT USE MORE THAN 15 PSI (103 KPA) OF PRESSURE.

Regulations

be aware of any local regulatory requirements for safety. For example, OSHA states that “All safety devices on ovens shall be inspected at intervals of not less than twice a month by an especially appointed, properly instructed bakery employee, and not less than once a year by representatives of the oven manufacturer”.

Make contractual arrangements with Baker Perkins for inspections of all Baker Perkins equipment as appropriate.

Tools

Always use the proper tool for the job.

Work Practices

When servicing or maintaining equipment it is strongly recommended that personnel never work alone. A “safety buddy” should always be standing by in case there is an accident.

There should be an adequate number of people present at **all** times work is taking place who are medically qualified. This includes normal operation as well as maintenance or cleaning activities.

4.12 Running the Equipment Without Safety Systems

In normal circumstances the equipment should not be operated unless all safety systems are fully operational. However, on very rare occasions and for very specific tasks, it may be necessary to run the equipment with some guards or safety devices removed.

Some electrical maintenance activities may require that the power is turned on.

WARNING THESE SITUATIONS ARE POTENTIALLY VERY DANGEROUS AND GREAT CARE MUST BE TAKEN TO EXECUTE THIS WORK AS SAFELY AS POSSIBLE.

Most accidents involving machinery are avoidable and happen due to lack of thought and by not taking suitable safety precautions for the task being undertaken.

Note The user is responsible for implementing safe working practice and procedures for this type of situation and the following notes are given for guidance only.

1 Is it absolutely necessary to have the power on or to operate the equipment without safety devices to carry out this particular task?
Have all possible methods of safely carrying out this work been thoroughly evaluated?

2 The person who is to do the work must be an employee that the user has authorised and who has received training to be able to carry out the task safely and effectively.

3 The person who is to do the work must carefully assess the risks and take all possible or practical precautions against injury or damage.
This person is responsible not only for his own safety but also for the safety of others.

4 Your own skill, care and self discipline are your best protection. Use safe working practice at all times. Examples of safe working practice would be:

- Use suitable protective equipment.
  For example when working close to moving parts a close fitting single piece overall suit in good repair should be worn. This should have no loose ends and no external pockets except a hip pocket. It should be worn in such a way that it covers all loose ends of clothing.
  Goggles, gloves and ear defenders are other examples of protective equipment which may be required.
- Only remove those guards that are absolutely necessary for carrying out the task.
- Another person who has been instructed in emergency procedures should be immediately available within sight or sound.
- Take steps to prevent anyone else being endangered.
  Use safety barriers or temporary guarding to ensure the safety of others.

4.13 Health and Safety

The user should carry out an assessment of the risks to health and safety from the use of this equipment, including the precautions to be taken to minimise any risks identified.

WARNING MAKE SURE THAT YOU UNDERSTAND THE RISKS AND WHAT PRECAUTIONS YOU SHOULD TAKE TO MINIMISE THEM BEFORE WORKING ON THE EQUIPMENT.

Issues to be considered include:-

1 Compliance with any relevant local safety regulations and codes.

2 Protection of employees against any bodily injury. Examples include:

- Hardhats
- Safety Glasses
- Ear Protection
- Gloves
- Overalls
- Dust masks
- Fume and Dust Extraction

3 Protection of employees against exposure to various hazards. For example hot surfaces are a particular hazard with ovens.

4 Maintaining clear visibility of *DANGER*, *WARNING* & *CAUTION* labels on the equipment.

4.14 Personal & Food Hygiene

You are working with food which is usually for human consumption. Therefore, it is essential that you maintain the highest standards of hygiene within the process area.

WARNING

YOU SHOULD HAVE RECEIVED TRAINING IN PERSONAL AND FOOD HYGIENE FROM YOUR EMPLOYER. IF YOU HAVE NOT, DO NOT USE THE EQUIPMENT OR ENTER THE PROCESS AREA.
ARRANGE TRAINING WITH YOUR SUPERVISOR OR TRAINING MANAGER.
WORKING IN THE PROCESS AREA WITHOUT AN ADEQUATE UNDERSTANDING OF HYGIENE CAN LEAD TO CONTAMINATION OF FOOD.

Below is a list of basic hygiene rules. This list is not a substitute for proper training by the user, and is issued here for guidance only.

- Wash your hands thoroughly before entering the process area.
- Remove your watch and any loose jewellery before entering the process area.
- If suffering from an illness or infection, obtain a Doctor's approval before working.
- Leave all medicines, pills and tablets which you need during the day in the First Aid station, securely locked away if necessary.
- Wear all provided protective clothing and headgear in the way instructed or recommended by your employer.
- Avoid touching your nose, ears and mouth when you are in the process area.
- Don't carry small loose items in your overall pockets.
- Never take food or drinks into the process area.
- Keep all tools in a box or bag.

4.15 De-Commissioning

The equipment should be decommissioned by skilled personnel trained in safe working practices for the installation and decommissioning of large industrial process equipment. The aim is to decommission the equipment such that it does not present any danger to personnel or the environment. The following points should be noted.

1 Blunt all sharp objects.

2 Remove all doors and hatches.

3 Secure or release hinged lids.

4 Do not torch or burn PTFE coatings.

5 Disassemble all gear trains.

6 Release pre-tensioned springs.

7 Disconnect all electrics.

8 Remove the drive motors.

9 Slacken all drive belts

10 Disconnect any cooling water hoses

11 Disconnect all air supplies

12 Drain any water jackets.

13 Drain lubricants from all gear boxes, hydraulic systems, oil baths etc. and dispose of correctly.

14 Handle any batteries with great care due to the acid contained within them. Dispose of correctly.

15 Clearly and indelibly mark the equipment to show that it has been decommissioned and must not be put back into service.

5 MPF24 Extruder Hazards & Risk Assessment

WARNING *The following information has been provided to highlight the potential hazards of the MPF24 Extruder. All personnel must become familiar with these points before operating, cleaning or maintaining the equipment.*

Generic Hazards for ALL machine types

1 Do not run the equipment without safety guards and covers. This may allow access to dangerous moving parts or high voltages which could cause serious injury or death.

2 Do not run the equipment without fully operational safety and E-stop systems. Without these protective systems there is a danger of injury and / or damage to the equipment.

3 Beware faulty or bypassed interlocks. These may allow access to moving or dangerous parts which could cause injury.

4 Keep your hands clean and grease free to prevent the danger of them slipping whist operating the machine controls and causing injury.

5 Take care when lifting and moving machinery components. Injuries could occur if heavy parts are lifted without using safe lifting and handling techniques.

6 Beware of nip and abrasion points on the machine which present the danger of injury. Although Baker Perkins provides safety guards so far as reasonable and practical there may be areas of the equipment which present a danger of entrapment or abrasion injuries, such as:

- Where rolls come together
- Conveyors and belts as they pass over or round rollers
- Scrapers, knives etc. pressing against conveyors and rolls
- Equipment which moves during normal operation
  Pneumatic cylinders and associated mechanisms
  Conveyor tracking and tensioning mechanisms
- Parts of the equipment which are moved by the operator
- Moving parts such as conveyors, (in particular the edges), and rolls.

7 Do not reach into parts of the equipment not normally accessible to an operator. The access to moving parts through the open areas of the equipment could cause severed/broken appendages.

8 Never use any machine or conveyor as a height aid to gain access to machinery at higher levels. Moving mechanisms may be accessible that would expose personnel to dangerous hazards.

9 Stored (or Potential) energy:

Energy may be stored in various systems such as Mechanical, Pneumatic, Hydraulic or Electrical. This can be hazardous if released in an uncontrolled manner.

5.1 Introduction

It is the policy of Baker Perkins to design, manufacture and test their range of equipment to comply with the essential safety requirements of the machinery directive.

This document is a Health and Safety Risk Assessment for the user of a Baker Perkins MPF24 Extruder. It details the hazards and areas of danger which exist with its use.

It also describes the Safety Measures which have been included within its design. For general notes on safety precautions - See “Safety” on page 15.

5.2 List of Hazards

Mechanical Hazards

- Crushing and Shearing
- Cutting and severing
- Drawing in or trapping
- The rotating parts of the cutter, drive and power transmission system
- The pivot closing movement of the barrel
- The pivot open movement of the product cutter assembly
- Projection of parts of machinery.

These hazards are principally due to:

- The rotating parts of the drive and power transmission system
- Moving parts in the extruder barrel
- The rotating agitators at the feed opening and discharge end
- Opening/closing of the barrel
- The accessible moving parts during purging, cleaning and start up
- Pivoting product cutter assembly
- The extruder itself if moved.

Electrical Hazards

- General hazards
- Electrostatic phenomena.

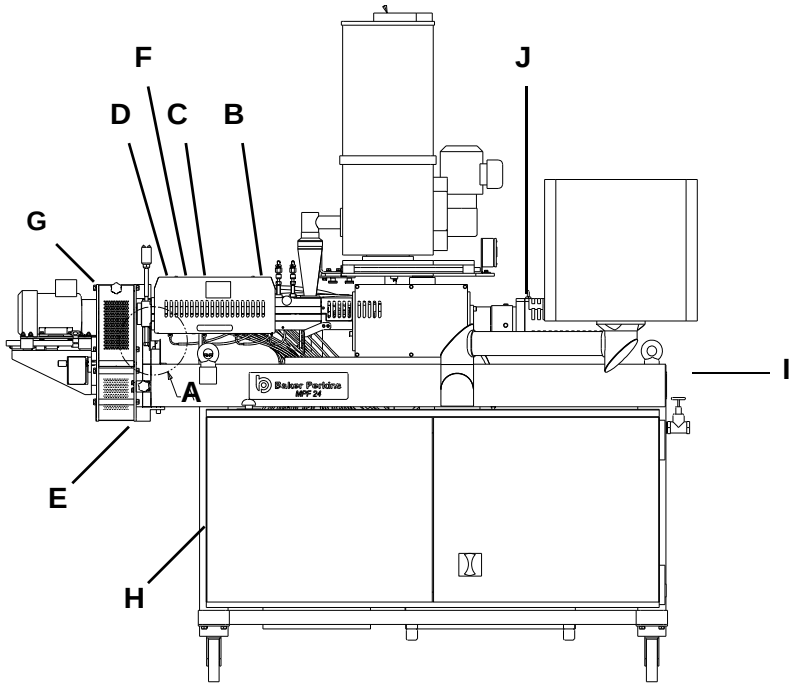
These hazards are principally due to:

- Poor maintenance or maintenance procedures
- Use of damaged equipment/components
- Washdown of non hoseproof machinery.

General Hazards

- Hazards caused by hot machine parts and hot extruded product
- Hazards generated by noise
- Hazards resulting from materials and substances used, and/or exhausted from the extruder/cutter
- Fire hazards
- Explosion hazards.

5.3 Areas of Danger



A	Burst Disc	General Hazard - Hot product at high pressure
B	Barrel feed openings	Mechanical Hazards
C	Barrel heating	General Hazard - caused by hot machine parts and hot extruded product
D	Removable & lifted components (barrel & belt assembly)	Mechanical Hazard - USE SAFE HANDLING TECHNIQUES
E	Hot extrusion discharge	General Hazard - WEAR APPROPRIATE SAFETY GLOVES & EYE PROTECTION
F	Closing the barrel	Mechanical Hazards - FINGER TRAP
G	Pivoting Cutter Assembly	Mechanical Hazards - FINGER TRAP
H	Control Panel	Electrical Hazards - High power, ISOLATE BEFORE OPENING DOORS
I	Machine Movement	General Hazard - take care when moving heavy mobile machinery
J	The drive and power transmission to; the agitator screws & cutter	Mechanical Hazards

5.4 Safety Measures

This section assumes that a Brabender Feeder or similar is fitted/supplied

Extruder & Cutter - Drive and Power Transmission

1 The main AC servo motor, is a direct drive to the splitter/reduction gearbox, via a coupling behind an engineer access cover.

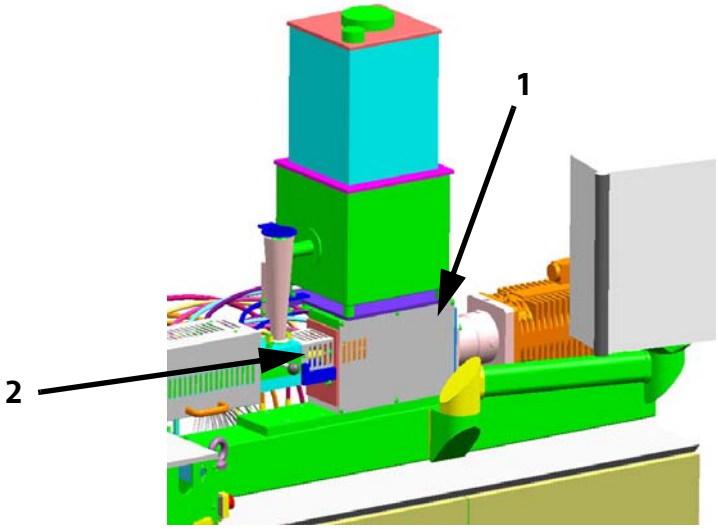
2 The splitter/reduction gearbox twin output shafts are connected to the twin agitator shafts by quick release couplings. If access is required to these couplings; they are protected by an engineer access cover.

3 The cutter drive motor shaft is guarded by a fixed cover; it is bolted in place - engineer access only (see next page).

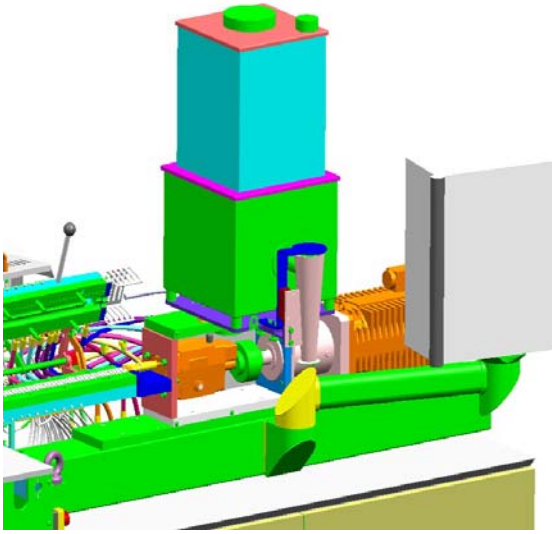
4 Access to the cutter is via interlocked guards.

Extruder Drive Guard in Place

See drawing no. SA13512 for details

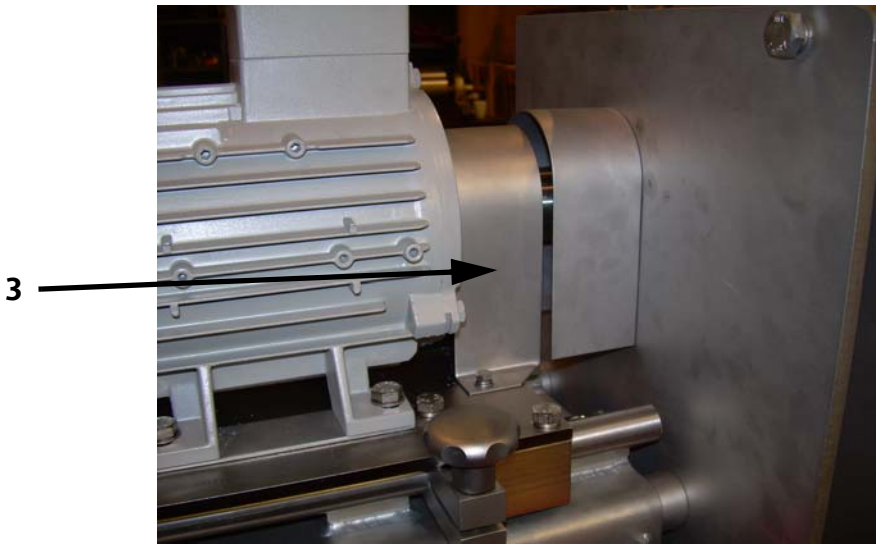


Extruder Drive Guard Removed

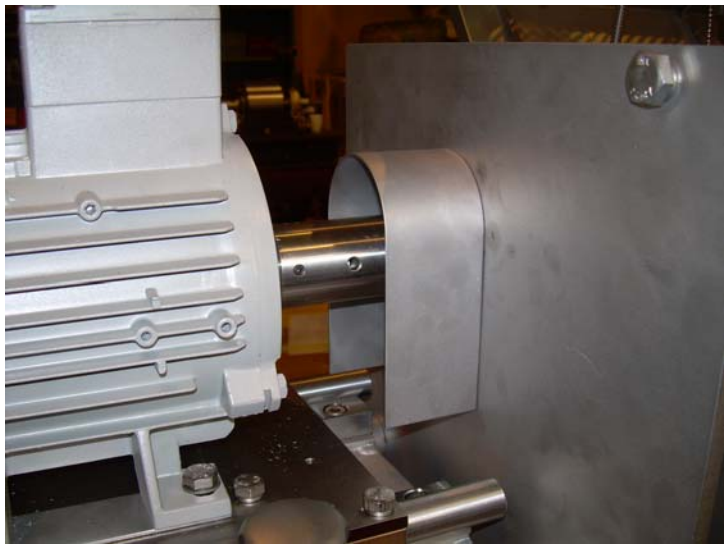


Cutter Drive Guard in Place

See drawing no. SA11882 for details



Cutter Drive Guard Removed



Barrel

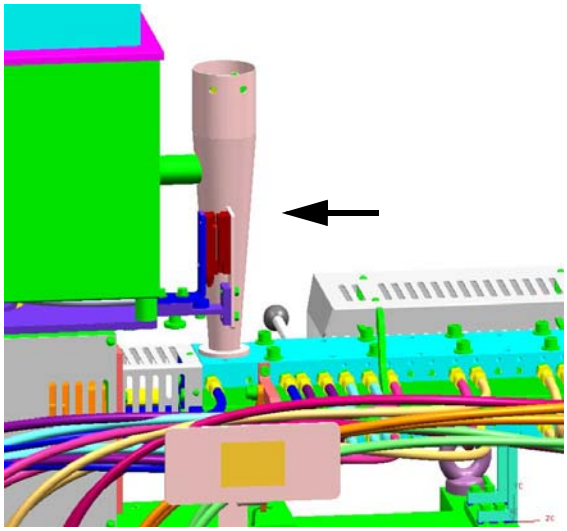
Main Feed Opening - With or Without a Feeding Device

The main feed opening is covered by an interlocked feed funnel which is fixed to the feeder assembly. This funnel prevents dangerous access to the extruder agitators - THIS OPENING MUST BE GUARDED WHEN THE MPF24 IS RUNNING.

The feed funnel must be in place before the main drive can be started.

Feed Funnel

See drawing no. SA13511 for details



Discharge Opening

The extruder discharge opening is guarded by the presence of the product cutter in front of the extruder barrel. When in the closed position, the cutter assembly prevents access to the hot extruder discharge and agitators.

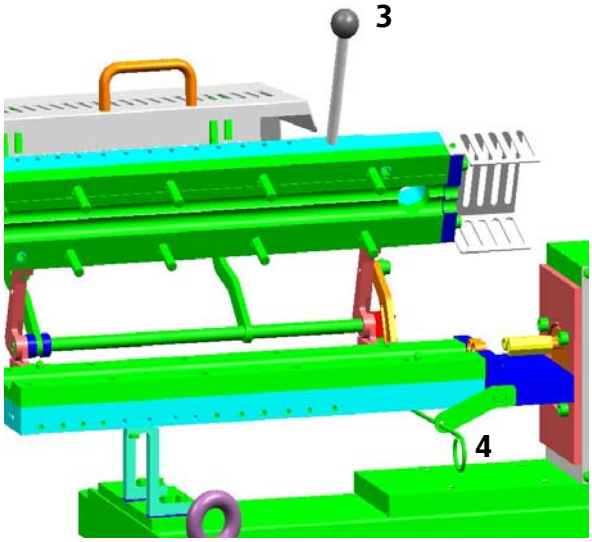
A trained operator may need to gain access to the product at the discharge by swinging open the cutter. He should only do so if wearing the appropriate safety equipment:

- Safety Goggles
- Heat Protection Gloves.

Barrel Clamshell Opening / Closing

See drawing no. NA10009 for details

WARNING NEVER REACH INSIDE AN OPEN BARREL TO RELEASE THE BARREL HOLDING LATCH - IF THE UPPER BARREL DROPS, HANDS/FINGERS MAY GET TRAPPED AND INJURED.



The barrel assembly is split along its horizontal centreline. The upper barrel half (which is hinged) can be opened upwards after the removal of the closure bolts. USE A FIRM GRIP WHEN LIFTING THE UPPER BARREL AS IT IS HEAVY.

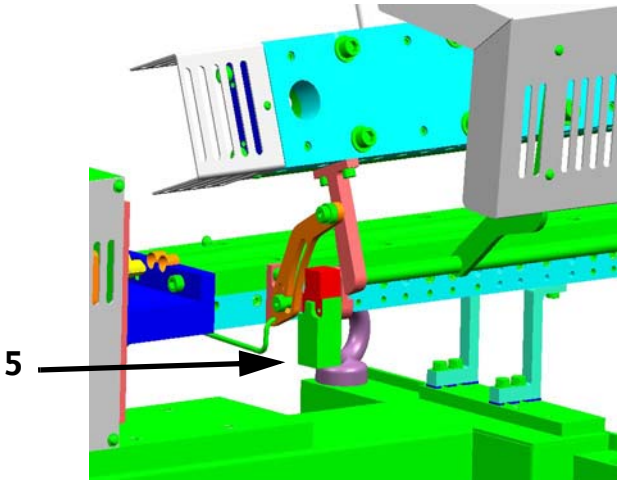
The latch is provided to guard against accidental closure.

Care must be exercised when closing the upper half down to the fixed lower half, to ensure that fingers do not become trapped.

The latch is released from underneath the barrel. Support the barrel weight with the handle ball (**3**), then release it from underneath using the ring pull (**4**).

A safety switch (**5**) is situated on the hinge mechanism of the barrel assembly; this is interlocked with the extruder main drive to prevent rotation of the agitators when the barrel is in its open position.

See drawing no. NA10009 for details



Note

Cleaning, purging and reconfiguration of the machine may require the product cutter to be in the open position. During normal operation of the extruder, this guards the dangerous discharge point.

Die In Place

A safety switch is fitted to the die assemblies; these are interlocked with the extruder main drive to prevent rotation of the agitators when a die is not fitted on the barrel end.

Moving the Extruder

The MPF24 Extruder is designed to be sited upon a flat, level and solid floor; it is not fixed or bolted into position. It is fitted with four castors, all of these are lockable (The castors may be replaced with an optional fixed frame to increase the height).

WARNING ON SOME TYPES OF FLOORS IT MAY BE DIFFICULT TO MANOEUVRE THE EXTRUDER INTO POSITION. IF THE FITTED CASTORS DO NOT ROTATE FREELY - DO NOT TRY TO MOVE THE MACHINE ON YOUR OWN.

The machine is provided with suitable lifting points. For instructions for siting and installation - See “Installation” on page 55.

WARNING OTHER METHODS OF MOVING THE EXTRUDER MAY LEAD TO INJURY OF PERSONNEL.

WARNING THIS EXTRUDER IS FITTED WITH A SCHENCK FEEDER SUPPLIED BY THE END USER. THE FEEDER MUST BE REMOVED FROM THE EXTRUDER BEFORE LIFTING AS THE EXTRUDER WOULD BE TOP HEAVY WITH THE FEEDER FITTED.

Electrical Hazards

General

Baker Perkins Extruders are designed and manufactured electrically to comply with:

- IEC EN 60204-1 as a minimum standard.

Other standards may be used to satisfy customer preference. However, these standards must be equal to or better than IEC EN 60204-1.

Electrostatic Phenomena

This condition is not envisaged in the foreseen use of the MPF24 Extruder.

However, where these conditions are known to exist, suitable preventative measures such as earthing or conductive discharge should be provided by the user.

General Hazards

- Lifting the MPF24 Extruder - See “Lifting Instructions” on page 55.

Hot Machine Parts

Barrel

During operation of the extruder, surface temperatures of the barrel could be up to 200°C. Health and Safety Regulations require companies to safeguard employees from accidental contact with the hot surfaces.

Guards are provided to the front and top of the Baker Perkins extruder barrel. These guards are designed to prevent personnel falling against, or accidentally coming into contact with, the hot barrel surfaces.

The barrel guard is hinged to enable easy access to the barrel bolts. The guard is not interlocked - IT MUST ALWAYS BE IN THE CLOSED POSITION BEFORE OPERATING THE EXTRUDER.

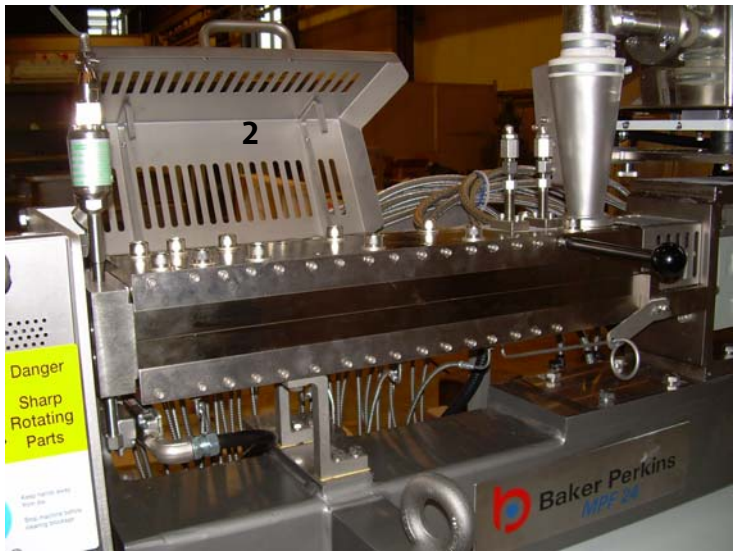
Note

Should the heating power be switched off and the front guards subsequently removed, there could still be residual heat within the barrel.

The design of the barrel guards does not restrict operator access to the top surface of the barrel or product discharge.

Danger signs for hot surfaces are displayed prominently on the front and rear guards.

Discharge (1) and Top (2) Barrel Guards



1

Discharge

During operation of the extruder, the hot extrudate may be in excess of 170°C. It is necessary to allow operator access to this area. Therefore, the user must exercise the correct authority to give access to this area during operation. The operator must be equipped with the correct heat resistant safety clothing, gloves and safety eye wear. Danger signs are displayed for hot surfaces.

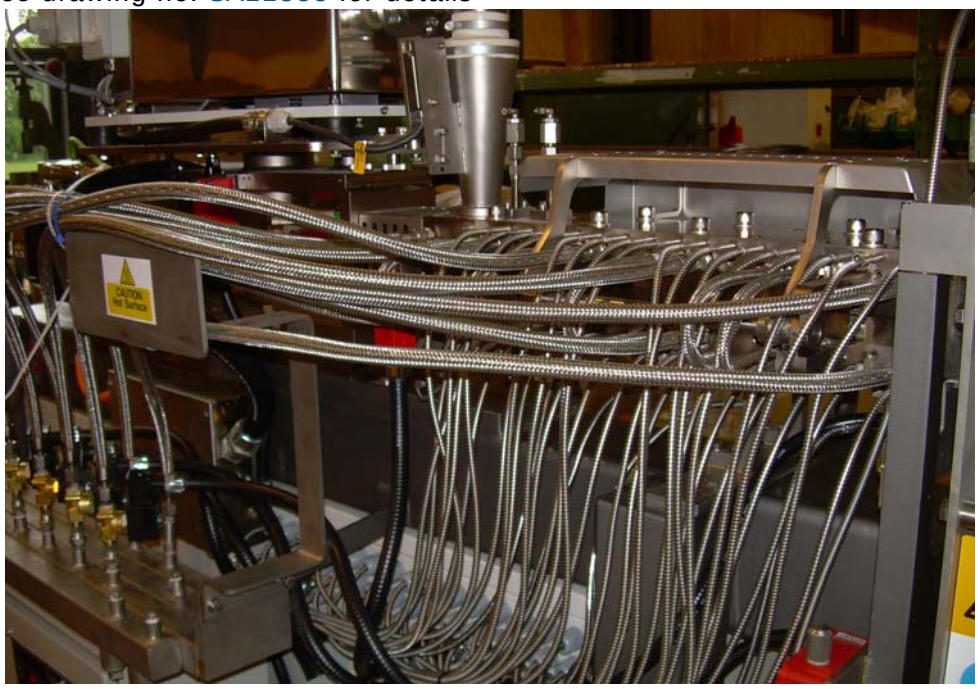
Pipes

Temperature control of the extruder is achieved by use of electrical heat energy input and water cooling. During this operation, water is cycled through cooling channels within the hot extruder barrel. The water return pipes and manifolds can be extremely hot.

WARNING DO NOT TOUCH THE HOT FLEXIBLE WATER PIPES - THIS COULD RESULT IN BURNS TO HAND AND FINGERS.

Hot Pipes

See drawing no. SA11883 for details



Hot Extrudate

Operator exposure to hot extrudate is only present at the discharge end of the machine, through the discharge opening - See “Discharge” previously.

5.5 Product Cutter Hazards

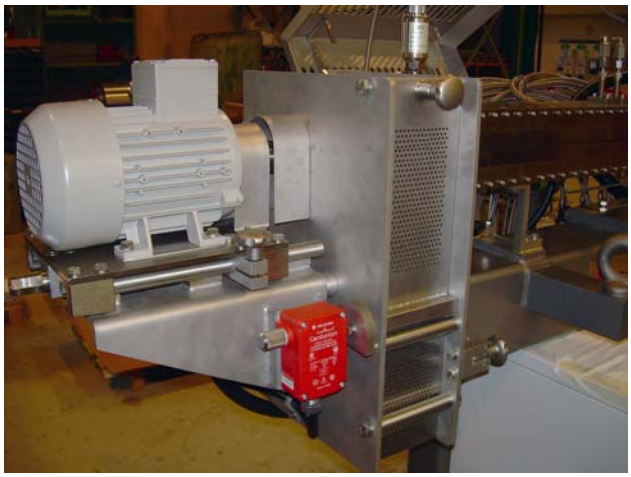
Product Cutting

The product cutter is fitted with a sharp two edge blade. Wear leather gloves to protect hands and finger when changing the cutter or undertaking cleaning and maintenance activities.

Product Discharge

See drawing no. SA11882 for details

closed position



open position

WARNING DO NOT PLACE HANDS AND FINGERS NEAR THE OPEN GUARD BOTTOM IF THE EXTRUDER IS OPERATING. ALWAYS WEAR APPROPRIATE SAFETY ITEMS; GOGGLES, LEATHER GLOVES AND OVERALLS.

The product discharge opening from the die is downwards. It is generally guarded by the presence of the cutter cage interlocked guard, but could be accessed from underneath.

Product Cutter Hazard

WARNING OPERATORS SHOULD BE AWARE THAT THE CUTTER CAN BE ACCESSED FROM BELOW THE CUTTER CAGE. WHEN THE MACHINE IS STARTED, DO NOT REACH UNDER THE CUTTER CAGE. IT IS THE CUSTOMER'S RESPONSIBILITY TO GUARD THIS INTERFACE AND PROVIDE TRAINING TO OPERATORS ON "HOW TO SAFELY ACCESS THE CUTTER".

Cutter Movement

Care should be taken when the cutter assembly is swung back into the operating position. Ensure hands and fingers are well clear of the nip point between the frames.

5.6 Additional Information

System Noise

The noise level from the Baker Perkins MPF24 Extruder is less than 80 dB(A) at 1 metre and is therefore not a hazard.

The sources of noise are:

- Main electrical motors
- Splitter reducer gearbox
- Materials being processed related noise

Substances/Materials

Substances entering the extruder may present hazards to health, by virtue of:

- The raw material properties
- By-products formed and released by the process
- The product itself
- Additionally there may be a possibility of reactions occurring between the product and residual matter from processing previous formulations.

An assessment of the potential risks involved and the safety precautions necessary with all proposed processes, must be exercised by the user.

Fire

There are no fire risks associated with the Baker Perkins extruder. All materials of construction have been selected for the relevant duty.

However, fire risks could be created from the surrounding environment. Particular attention should be given to the possibility of flammable materials inadvertently coming into contact with the hot extruder barrel, i.e. flammable liquids such as oils, or flammable powders leaking or being accidentally spilt from floors or steelwork sited above the extruders.

Explosions

There are usually no explosion risks associated with the Baker Perkins extruder when used for processing the envisaged normal range of products.

When the process is known to have an explosion and/or fire risk, this requires a machine specifically designed both mechanically and electrically, to meet the specification parameters of each particular application and is not within the scope of this Risk Assessment.

Residual Risks

Mechanical

There are no residual risks mechanically, i.e. there is no stored energy from mechanical movements, hydraulic fluid or compressed air accumulators causing mechanical movements.

There is a residual risk from the presence of hot water within the barrel temperature control system - See “Pipes” on page 38. Access to this area may be required for maintenance reasons.

The joints on pipes and manifolds must not be slackened until the temperature has been reduced to a safe level.

Electrically

- There are no residual risks electrically.

Hot Surfaces

There are residual risks from hot surfaces in the barrel and discharge areas of the machine. The barrel is provided with top cover - See “Barrel” on page 37. However, it is sometimes necessary to hinge the cover open to gain access to the barrel and accessories, or on shutdown to carry out good housekeeping procedures. Although the heating energy has been isolated, it will take a considerable time for the heat to dissipate from the barrel and its accessories.

All the precautions as detailed - See “Discharge” on page 37. must be implemented by the owner, with respect to correct authority, safety clothing etc. until the machine temperature has been proved to be at a safe level for normal access.

Process

There may be residual risks with some processes. Safety measures taken by the user when processing hazardous materials, must comply with safety legislation relating to hazardous substances.

A burst disc is fitted to the discharge die which is designed to rupture and divert excess barrel pressure/product down towards the floor.

CAUTION *Only use a genuine Baker Perkins burst disc. Do not use a standard bolt as this may cause serious damage to the extruder.*

Temperature Control of Heated Areas

Temperature control devices are provided for each temperature controlled zone along the extruder barrel. Heat sensitive devices, usually thermocouples, are provided and are located in each zone. If any one of the heat sensitive devices fails, the temperature control device will shutdown the electrical heating energy on that particular zone. This will prevent the maximum permissible temperature from being exceeded. It is at the discretion of the operator to determine if any remedial action is immediately necessary.

5.7 Machine Control System

The machine control system is designed to meet the requirements of:

- BS EN 1114-1 *and* IEC EN 60204-1

Emergency Stop Device

Emergency stop push-buttons are sited on the top of the extruder control panel and on the operator facia. These push-buttons are clearly visible and are immediately accessible to the operator.

TIP

on operator control facia & top left of control panel

5.8 Purging/Cleaning/Reconfiguration of the Extruder

These are activities normally performed by the extruder operator. The degree of cleanliness required, is dependent upon the range of products that are required to be processed on any one particular extruder. The cleaning operation can vary from a simple purge run, (with a suitable inert material), to the opening of the extruder barrel, removal of the agitator assemblies, disassembly of all agitator components, thorough cleaning and reassembly.

Purging

When it is necessary to lift open the discharge guard for purging, the user must have in place a system of authority to work with the extruder in open discharge state - See “Discharge Opening” on page 34. The operators with authority must have been appropriately trained.

Materials used for purging must be appropriate to the work place environment, i.e. must be safe to use.

Cleaning

WARNING WHEN IT IS NECESSARY TO OPEN THE EXTRUDER TO REMOVE THE AGITATOR ASSEMBLIES, IT IS ESSENTIAL THAT THE EXTRUDER MAIN DRIVE IS FIRSTLY ELECTRICALLY ISOLATED.

There are some hazards involved; the risks to the operator are:

- Residual material from the process - See “Process” on page 41.
- Hot surfaces
- Mechanical movements.

Hot Surfaces

Hinging the extruder barrel cover open exposes hot surfaces and hot components. As it is quite often necessary when cleaning an extruder to retain some level of heat energy, it is necessary for the user to have in place a system of authority to work with the guards removed. The operators must be equipped with the correct heat resistant safety clothing, gloves and safety eye wear.

Plugs & Sockets

Always check that multi-pin plugs used for power, data and device connections are clean and dry before replacing them in their respective sockets. The water tight cover must be clipped in place over the socket before commencing any cleaning procedures.

Mechanical Movements

The company using the extruder/cutter should have a documented "system of authority" to allow authorised personnel to disassembly the machine.

Materials and methods used for cleaning must be appropriate to the work place environment, i.e. must be safe to use.

The cutter assembly may be pivoted into the open discharge position at extruder startup up until suitable product is being discharged.

Reconfiguration of the Extruder

When changing products or modifying a process, a change of agitator configuration is quite often required. It will be necessary to open the barrel to change the agitator configuration.

WARNING IT IS ESSENTIAL THAT THE EXTRUDER MAIN DRIVE IS FIRSTLY ELECTRICALLY ISOLATED AND NOT RESTORED UNTIL THE BARREL ASSEMBLY IS CLOSED AND THE DISCHARGE GUARD HAS BEEN SECURELY FASTENED INTO PLACE, READY TO COMMENCE SAFE OPERATION.

5.9 Maintenance Procedures

Maintenance personnel must be aware of all the risks associated with operation of the extruder. They must also be familiar with the purpose of all guards, interlocks and any other safety devices provided.

The user must have in place a system of authority which gives safe maintenance procedures both mechanically and electrically.

5.10 Danger and Warning Signs

See the drawing no. SA11899 for painting and labelling of MPF24 Extruder, this drawing identifies all labels and their position on the machine.

Electrical & Feeder Hazard Labels

Hazard Warning Labels

6 Baker Perkins Customer Support

6.1 Customer Training

Baker Perkins can supply training programmes in support of this equipment. The objectives of the training can be:

- Improved Operational Performance, and Efficiency
- Rapid Equipment Optimization
- Reduced Start-up Costs
- Improved Maintenance Performance
- Safety Awareness
- Hygiene Awareness
- Assists In Meeting Employer's Legal Obligations For Training.

For further information on this service, please contact Baker Perkins at the address given at the front of this manual.

6.2 Plant Automation Systems

Plant automation systems from Baker Perkins can be retro fitted to provide benefits in overall process and business efficiency. The systems deliver these benefits by giving operators, engineers and supervisors accurate and relevant information from anywhere in the plant. The information is presented using the most understandable text or graphical method e.g. real time trend, summary sheet etc. This enables decisions to be made based on a complete picture of the process rather than only the parts that can be seen.

Not only do "InTouch" systems provide a much greater range of information they also have a number of features that can help operators, supervisors and engineers interpret it quickly and correctly to reduce costs, improve quality and increase business efficiency. These include:

- Touch screen interfaces with clear graphics and intuitive operation.
- Recipe management for controlled access to process and machine setting information
- Alarm information that reduces the time taken to trouble shoot problems
- Trend graphs that help operators identify and respond quickly to process variations
- Baker Perkins automation systems are customized to suit individual applications using industry standard "Wonderware" software.

6.3 Customer Support

Baker Perkins is committed to delivering the highest standard of service to its customers and is continually striving to improve the quality and range of services it provides.

Baker Perkins and its customers have the benefit of an international network of wholly owned subsidiaries and agents located in all of the major markets of the world. Customer Service is co-ordinated from the Baker Perkins headquarters in Peterborough, England. These facilities feature a 'state of the art' parts warehouse providing over 2000 cubic metres of shelf space.

Baker Perkins maintains a comprehensive stock of replacement parts available for immediate delivery. This stock is complemented by a fast track manufacturing ability and supported by an engineering archive containing records from the turn of the previous century!

A 24 hour breakdown service ensures that urgent customer requirements are satisfied at any time of the day or night.

Baker Perkins' extensive range of technical services includes:

- Plant audits
- Product and process support
- Refurbished machinery
- Equipment upgrade packages
- Preventive and predictive maintenance planning
- Machine inspections and repairs
- Service contracts
- Plant relocation
- Product design services.

Baker Perkins' service team is dedicated to supporting its customers to ensure that Baker Perkins' products give superior performance at a low cost of ownership.

Baker Perkins Customer Support would be delighted to hear from you and to give you whatever assistance you require - please contact us.

World Support	USA Support
Baker Perkins Ltd. Manor Drive Paston Parkway Peterborough PE4 7AP - UK Phone: +44 (0)1733 283222 Fax: +44 (0)1733 283010 Email: bpltd@bakerperkins.com	**Baker Perkins Inc.** 3223 Kraft Ave. S.E. Grand Rapids MI 49512-2027 USA Phone: +1 616 784 3111 Fax: +1 616 784 0973 Email: bpinc@bakerperkins.com

For replacement agitator parts visit www.extruderspares.com

7 Introduction to MPF24 Extruder

The MPF24 Extruder is an integrated machine incorporating feeding, twin-screw extruding and product cutting operations in one compact unit.

Developed after consultation with customers, this versatile machine meets the growing demand for a rapid-response system capable of laboratory trials and small batch production needs. In addition, the unit can be re-configured, without the need for tools, to enable production of colour matching samples.

Baker Perkins proven High Free Volume screw geometry is suitable for processing a wide range of extruded food products.

The machine can be cleaned rapidly to whatever level is required. The clamshell barrel allows complete shaft and screws assemblies to be simply lifted out for cleaning and also provides easy access to the internal barrel surfaces.

Most feeders are mounted on a swivel plate to allow off-line cleaning

These features also maximise flexibility and minimise downtime by allowing rapid change over or reconfiguration of shaft assemblies as well as providing easy access for maintenance and process troubleshooting

The fully integrated control interface is mounted on a swivel pendant to maximise access. The maintenance free brushless servo motor allows speeds of up to 1,000 rpm to be used (dependent on model) and improves reliability by reducing stress on the drive components with soft start technology.

The machine is mounted on castors and delivered to site fully assembled, wired, tested and ready for connection to site services.

The extruder is fitted with an integrated Product Cutter. Fitted safety interlocks allow the cutter to be swung open for cutter change or direct product extrusion. Accurate speed control of cut product is via the operator HMI.

The MPF24 Extruder incorporates all the proven advantages of Baker Perkins market-leading powder coating extruders - the company has been involved in powder coating since the material was developed over 30 years ago, and capability ranges from laboratory-scale units to high output plants.

8 Information for Transport, Handling and Storage

8.1 Packaging

The MPF24 Extruder, support frame, feeder and control panel are supplied as one completely assembled unit and will be either:

1 Packed into a single wooden case for shipment outside the British Isles.

OR

2 Secured to a wooden pallet and protected with a plastic sheet, for delivery within the British Isles.

8.2 Handling

When packed, the wooden case or pallet can be handled with a fork lift type truck, or suitable slings and a hoist. The wooden case will have a packed for shipment total weight displayed on the outside of the case.

The wooden pallet will have a maximum weight indication displayed on the packing.

WARNING ENSURE THAT THE EQUIPMENT USED, FORK LIFT OR HOIST AND SLINGS, ARE SUITABLE FOR THE TOTAL WEIGHT TO BE LIFTED.

8.3 Removal of Packaging

The assembled unit in its packaging, should be placed on the floor area on which it will finally be sited.

- If packed in a wooden case, remove the sides, ends and top of the case.

OR

- If secured to a wooden pallet, remove the plastic protection sheet.

Remove any securing fixtures which are securing the equipment to the wooden bases. The unit is now ready to be installed - See “Installation” on page 55.

9 General Information - Baker Perkins Equipment

9.1 General

The Baker Perkins warranty applies in so far as the equipment is operated within the rating and service conditions for which it was specifically provided. The equipment must be installed, operated and maintained in accordance with good practice and the instructions contained in this Manual.

Unauthorised modification of machinery supplied by Baker Perkins will invalidate the warranty. We will not be held liable for any personal injury, problems or damages arising from modifications that have not been approved by us.

The client must prevent the existence of **any** destructive external conditions, such as:

- Loads due to excessive speeds or throughputs
- Severe shock loading
- Mechanical or thermal overloads
- Environment - temperature and humidity outside design specifications
- Power and fuel supplies outside design specification
- Other conditions of which Baker Perkins has not been fully advised.

Adequate installation, operation, maintenance, and safety instructions must be given by the user to all personnel responsible for the operation and / or maintenance of the equipment as appropriate to support safe and effective working.

9.2 Machine Markings

A metal number plate that displays the CE logo (if applicable), Baker Perkins logo and address, machine name, machine number, year/contract number, power consumption in kW, and any patent details, is secured on each machine. The location of this number plate varies with each machine and it is usually indicated on the Key Plan drawing in the Parts Lists section of this manual. The machine name, machine number and year/contract number should be quoted when ordering spare parts.

9.3 Prolonged Storage

If installation and / or operation of the equipment is to be delayed for more than one month after factory shipment, Rust Preventative Treatment should used on bare metal parts. The precautions can be taken by Baker Perkins if full information concerning storage conditions is provided at the time of ordering or alternatively by the user in the field. Baker Perkins warranty on the equipment can be modified by agreement to accommodate the storage period.

If prolonged storage is necessary, it should be indoors and preferably in a dry area having a relatively constant temperature. When outdoor storage is unavoidable units should be raised off the ground on skids and should be covered by a tarpaulin or an equivalent protective covering.

Protection for Storage

1 Coat all non-painted surfaces with an anti-corrosion compound. Stainless steel and nickel plated components do not require any additional protection.

2 Attach bags of desiccant inside all the electrical enclosures, to prevent any deterioration of the electrical components.

3 Ensure that the gearboxes are filled with the correct oil.

Attention During Storage

Turn over all rotating equipment at least two complete turns of the output shaft at regular intervals, (every two weeks), to prevent damage being caused to bearings, bushes etc. caused by parts remaining stationary for extended periods.

9.4 Installation

Rotation Of Machines

Some equipment is designed to operate in one direction only, especially that having cam operated movements and tensioned chain drives, and may suffer serious damage if the drive motors are run with incorrect direction of rotation. Before operating the equipment check for correct direction of motor rotation. Disconnect the belt, chain or coupling where possible.

When using a portable machine in an area with several power sockets, ensure that each socket is similarly connected to the mains supply thus producing the same rotation at each point.

Before starting any new equipment, the moving parts must be checked for freedom of movement by rotating by hand where possible or practical.

Insulation Test

Transportation or storage may result in dampness or damage to the electrical system. Insulation tests should be carried out using a suitable instrument to determine that the electrical system insulation is acceptable.

CAUTION *Do not connect the test instrument to any parts of the electrical system which may be damaged by the high voltages involved in the test. For example:*
Low voltage systems
Electronic equipment
Thermistors

Before Initial Start Up

CAUTION *Do not run the equipment until all lubrication requirements have been carried out.*

Note Before despatch all exposed polished parts and machined faces are coated with a rust preventative compound. This may be removed by rubbing with an edible oil followed by washing with a detergent solution.

Carefully check all areas of the equipment to ensure that all debris, swarf etc. that may have been left over from the installation period is removed and that the equipment is in a clean and tidy condition and is safe to start. In particular check the condition of the electrical control enclosures to ensure that there is no debris which may cause short circuits or other problems.

Check that the wiring is in a safe and tidy condition and that any modifications that may have been made during the commissioning period are installed to the correct standards and that they are documented.

10 Glossary of Terms

In this operation manual, certain terms, phrases and abbreviations are used which may be unfamiliar. The following list of terms and their definitions is therefore offered to assist the reader.

Term	Definition
CIP	**Clean In Place.** A device, system or method used to clean or washout the equipment without disconnecting it. Sometimes known as Wash In Place.
Drg No.	**Drawing Number**. The number assigned to a particular picture associated with a Parts List.
HMI	**Human Machine Interface.** Many machines are fitted and controlled from electronic operator control facias. The unit is then connected to the PLC (see below) in the control panel. It is sometimes referred to as an "OIT" - operator interface terminal.
KA	**Key Assembly**. The top level parts list of a plant which includes a number of individual unit machines.
KP	**Key Plan**. The top level parts list of a individual unit machine (as picked up on a plant parts list.)
SA	**Sub Assembly**. An assembly of components, usually picked up by another assembly.
Megger	An electrical device used to generate high voltages for testing the insulation resistance of electrical circuits.
OML / OEM	**Other Manufacturers Leaflet / Original Equipment Manufacturer**. A leaflet or instruction manual for an item of equipment not manufactured by Baker Perkins, but fitted wholly or in part to the equipment supplied by Baker Perkins; e.g. A Drive Motor.
BOM / PL	**Bill of Materials / Parts List**. A list of all the components supplied on a particular machine. This list is commonly used for cross referencing with drawings to identify a component; e.g. when ordering spares.
Pic.	**Picture**. This is an abbreviation of the word ‘picture’ and is likely to appear after a number or title in the parts list index. It is used to indicate that the particular number or title referred to, is a drawing, rather than a parts list.
PLC	**Programmable Logic Controller**. A microprocessor (computer) based electronic device, used to control a system or process.
SRL	**Standard Recommended Lubricant**. One of the lubricants preferred by either Baker Perkins or a supplier for use in the equipment.

11 Installation

11.1 Handling

Exercise caution when handling the unit to prevent damage from striking other objects.

CAUTION *Avoid picking the unit up with chains or slings placed around shafts, as this could damage gears and bearings.*

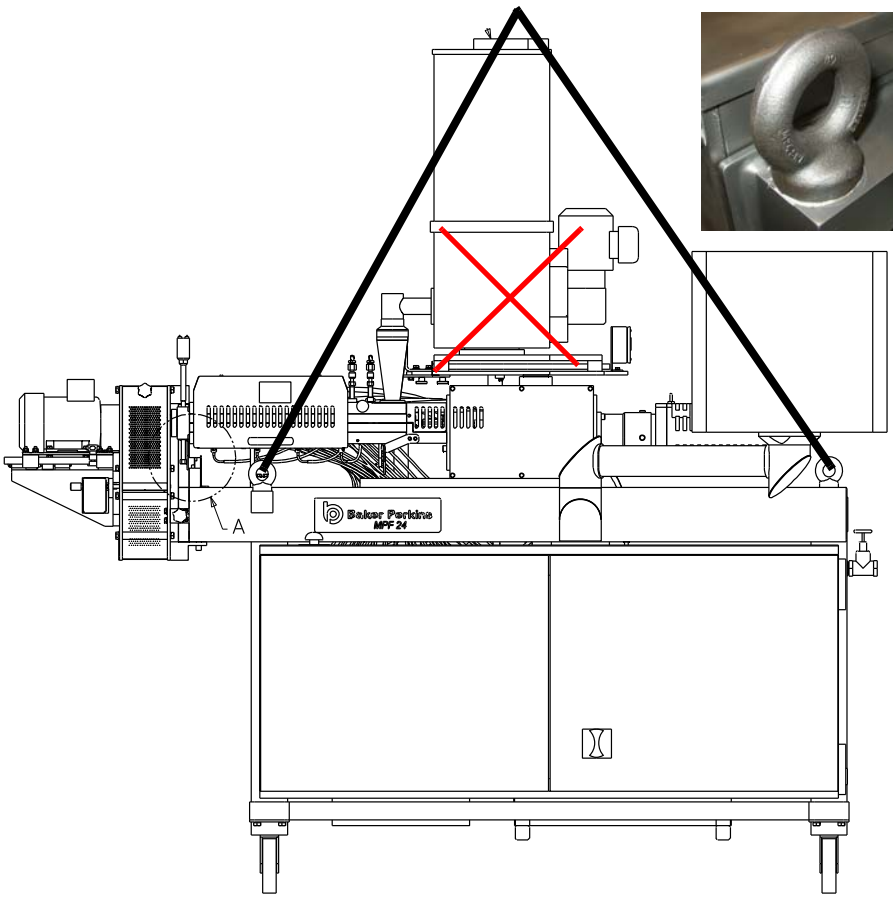
Care must be taken to avoid supporting or lifting in a manner that would place excessive stress on parts that are not designed to support the unit weight. When the unit is resting on the floor, it should always be in a normal upright position with the weight resting on the mounting surface.

Lifting Instructions

Always use the fitted eye bolts, see to the KP drawing for the weight of machine - See “Bill of Materials” on page 155.

WARNING NEVER ATTEMPT TO FORKLIFT THE UNIT FROM THE BACK AS IT IS TOP HEAVY. THE EXTRUDER IS TOP HEAVY AND SHOULD ONLY BE LIFTED USING ALL THREE FITTED EYEBOLTS.

3 FITTED EYEBOLTS.



Do not lift the extruder with the Schenck Feeder fitted as shown above as it will be top heavy.

11.2 MPF24 Extruder Location

The machine must be sited on a solid flat area, which is of suitable strength to resist the total weight of the machine, with no deflections or deformations.

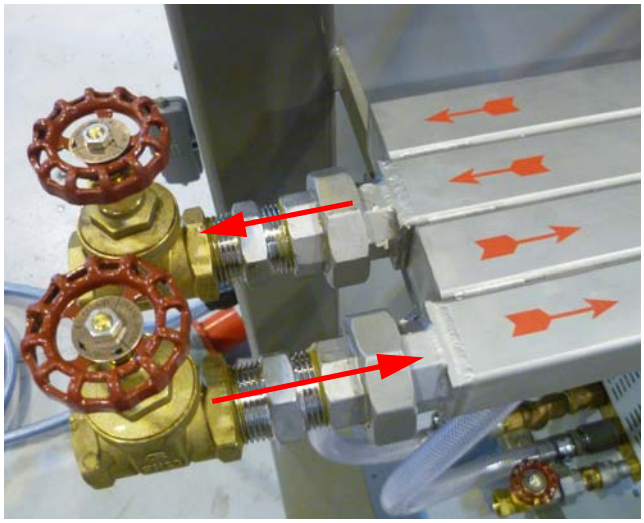
This area may be a concrete foundation, or in some cases a steelwork floor. In either case the area supporting the machine must be unaffected by the proximity of other machines or the passage of passing transport.

Refer to the general arrangement drawing for the weight and floor area dimensions of the machine - See “Bill of Materials” on page 155.

The machine should be positioned within the building to allow easy access for any lifting equipment that is necessary for the removal of major components, such as gearbox, motor and barrel assembly. Minimum recommended distances would be 1.5 metres on either side of the machine and 0.6 metres between the main motor and any wall or other adjacent machine.

Barrel Cooling Unit

optional barrel cooling unit



Water connection points - 1" BSPT

If not supplied by Baker Perkins, a separate treated water unit for extruder barrel temperature control is required to be sited on the rear of the machine frame (or at the same floor level). It should be connected to the two 1/2" NPT fittings on the unit - see drawing SA13503 and Tricool (ICS).

Feeder<>Extruder Interface Signal

The Extruder control system has been designed to incorporate control of an externally supplied Shenck Accurate feeder, see Feeder Interface Signal Specification for details.

Liquid Pumps

Inlet Ports

The peristaltic pumps and tanks are fitted on a mobile frame that should be located close to the extruder. The feed ends of the supplied flexible tubes should be connected to the tanks "T" piece outlets. The small ID tube is for the water feed, the larger ID is for the oil feed. Both tubes should then fitted to the pump heads - see page 97 of the Marlow 530 Pump user manual for details of the gearhead. The tube outlets should then be connected the extruder barrel inlet ports (photo above left), see drawing SA11904. The pumps are connected to the extruder system via the fitted plug, which goes into the power supply socket on the end of the machine control cabinet.

Control of the pumps is from the Main Auto Control Screen, see also 530 Pump.

Control and Power Panel(s)

The MPF24 Extruder is designed as an integrated unit and is normally supplied with the control panel fitted onto the base frame.

It is advisable that any additional free standing electrical panels (control and power) are positioned on site after the machine has been positioned and heavy lifting equipment has been removed from the area.

A control panel should be sited in a suitable position, preferably at the front of and at right angles to a machine, so an operator can observe any control instruments and the operation of the machine from the same position.

11.3 Alignment & Levelling

Optical alignment of the barrel and gear drive unit are factory fixed and do not require any further alignment.

As the machine is supplied with 4 non-adjustable castors, it should be positioned on a solid flat floor.

CAUTION *Always ensure the castors are locked before operating the machine.*

11.4 Extruder Lubrication

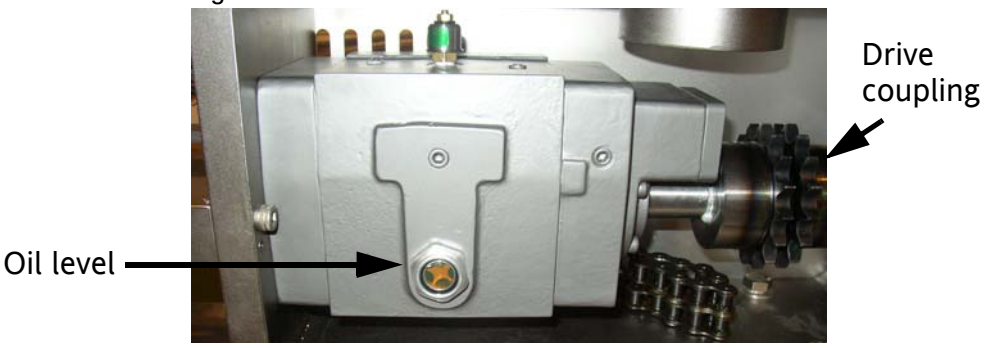
Drives (Electrical Motor)

- See "Siemens (cutter drive)" instructions for lubrication in the OML Section.

Splitter Gearbox Unit

- See "Hygate (David Brown)" in the OML Section

Extruder units are generally delivered without oil. The splitter gearbox must be filled with oil through a funnel and flexible hose, in the filler/breather hole in the top of the gearbox. The oil level should be set to the top of the sight glass at “standstill”. It should not fall below the bottom of the glass when “running”.



Recommended Lubricant

- ISO VG 320EP (0.37 litre)

Note If the gearbox is supplied pre-filled - Shell Omala 320 oil has been used.

Before starting unit, fill to proper oil level. After about two weeks operation, drain the gear case and flush thoroughly with light flushing oil.

The above recommendations apply to normal operating conditions.

Some of the conditions that warrant extra consideration in the choice of a lubricant or the periods between oil changes are.

- Extremely humid, chemical or dust laden atmospheres
- High ambient temperatures
- Rapid changes in temperatures to cause sweating in the gear case
- Frequent periods of shock loading

If in doubt, have your lubricant supplier make an "on the spot" recommendation. He is best qualified to determine the need for oils with a higher viscosity, containing rust and oxidation inhibitors, or containing extreme pressure additives.

Extruder Barrel (Discharge End)

During normal operation, the MPF24 agitators are "lubricated" by the product being extruded. Without product, the moving agitators and barrel would soon get very badly scored.

- See also "Tightening Torques" on page 137
- and "Product Cutter" on page 65.

11.5 Services

Electrical Connections

First ensure that your electrical supply is compatible with the supply required by the control panel and that the loading is adequate. This information can be found on the label sited inside the control panel door.

Before switching on the electrical supply for the first time, ensure that all local Regulations for Electrical Installations have been adhered to, (e.g. IEE Wiring Regulations 16th Edition.) This covers fusing, overloads, circuit protection devices and cable schedules.

Refer to the Electrical Parts Lists and Wiring Diagrams in the See "Bill of Materials" on page 155. for fuses and overloads etc.

Feeder (not part of Baker Perkins supply)

The MPF24 Extruder is usually supplied with a feeder unit pre-fitted.

If it is supplied without one, a plug and socket may be supplied - see See "Bill of Materials" on page 155. for details of the electrical connections.

11.6 Cooling Water Supply Requirements

The barrel and the gearbox require water supply at 4 bar pressure, and at the following flow rate. The flow rate is dependent on the water temperature.

Water Temp.	Flow Rates litres/hour			
°C	15:1	20:1	25:1	30:1
4	153	218	284	353
15	204	291	381	474
20	240	342	449	560
30	368	529	700	883

Note

Refer to the general arrangement drawing for your individual requirements. See "Bill of Materials" on page 155.

If a non-reusable water supply is utilised a water drain facility will be required.

11.7 Commissioning

Prior to commissioning, the machine should have been sited on a flat level and solid surface - and the castors locked. Any additional control panels sited and the following services completed:

- Mains electrical supply connected
- Cooling water supply connected
- Interconnecting wiring between the machine and the main power supply completed.

WARNING UNDER NO CIRCUMSTANCES SHOULD THE ELECTRICAL SUPPLY BE ENERGISED I.E. THE MAIN ISOLATOR SHOULD BE LOCKED IN THE OFF POSITION.

If commissioning is under the supervision of a Baker Perkins Service Engineer, he will supervise the following:-

1 Ensure that a suitable machine location has been chosen.

2 Check all power and water connections to the extruder, cutter, feeder, pumps and chiller unit.

3 Fill the extruder barrel cooling unit with treated water.

4 Check direction of rotation for All Units is correct.

11.8 Electrical Commissioning

The machine may now be electrically commissioned. This will usually be done under the supervision of an Baker Perkins Service Engineer, after all installation hard wiring has been completed by the installer.

1 Ensure that the extruder and feeder are running in the correct direction of rotation (see also “Direction of Rotation” on page 61) by observing the output shafts of the splitter gearbox unit.

2 Check the cutter assembly is revolving in the correct direction.

3 All safety devices must be checked for correct function, before operating the machine.

11.9 Final Mechanical Commissioning

1 Before starting the extruder unit, check that the gearbox is properly filled with oil. For further information see gearbox datasheet/drawing.

Note When gearbox is started up for the first time, it should (if possible) be run unloaded for several hours.

2 Open the clamshell barrel - See “Procedure for Opening Barrel” on page 121.

3 Agitator Assemblies: these are supplied pre-fitted inside the MPF24 barrel. If required, check that the phasing of the agitators and axial clearances between paddles are correct - See “Procedure to Remove Agitator Segments and Shafts” on page 122.

4 Use an allen key in the end of the agitator shaft to turn the agitators, splitter gearbox, coupling and main drive motor unit through a few revolutions by hand. This will ensure that the components turn freely and that there is no misalignment between agitators.

CAUTION *Always ensure that the mating faces of the barrel are free from burrs or any product etc. When the bolts are fully tightened it would result in damages to the machined faces.*

5 Close the clamshell barrel together and tighten the bolts - See “Procedure for Closing Barrel” on page 121.

6 Fit the transition plate and the required die - See “SA13514” on page 167.

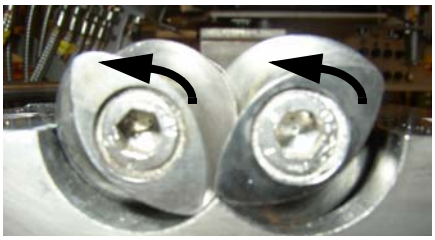
7 Replace and close all guards.

8 Check the cutter is well clear of the die face - see “Setting the Cutter end stop relative to the Die face” on page 67

9 Give final check to the unit for any visual signs of damage to any other parts i.e. heaters, cables, water pipes, fittings etc.

Direction of Rotation

The correct direction of rotation of the agitators is as shown below, when looking at the discharge end of the barrel, i.e. **correct rotation is counter-clockwise.**



DO NOT run the machine empty for any appreciable length of time. If machine is run empty, coat the barrel liner bore for approximately 100mm at the discharge end with a thin coat of silicone grease (or other lubricant not detrimental to the product being mixed). This lubricant is used to protect the barrel liner bore until the material being mixed has completely filled the extruder barrel and stabilized the screw. **Unless this precaution is taken, severe scoring may occur.**

CAUTION *For this reason, the machine MUST NOT BE RUN EMPTY for any appreciable length of time.*

VERY LOW SPEEDS only should be used in this condition.

After the first few hours of running check for:

1 Any bolts or nuts that may have worked loose (If so carefully tighten).

2 Oil leaks.

11.10 Barrel Temperature Control System (Water)

The barrel temperature control system is a combination of electric heating and water cooling.

The barrel water cooling is from a closed loop water system utilising a separate cooling unit with an integral heat exchanger.

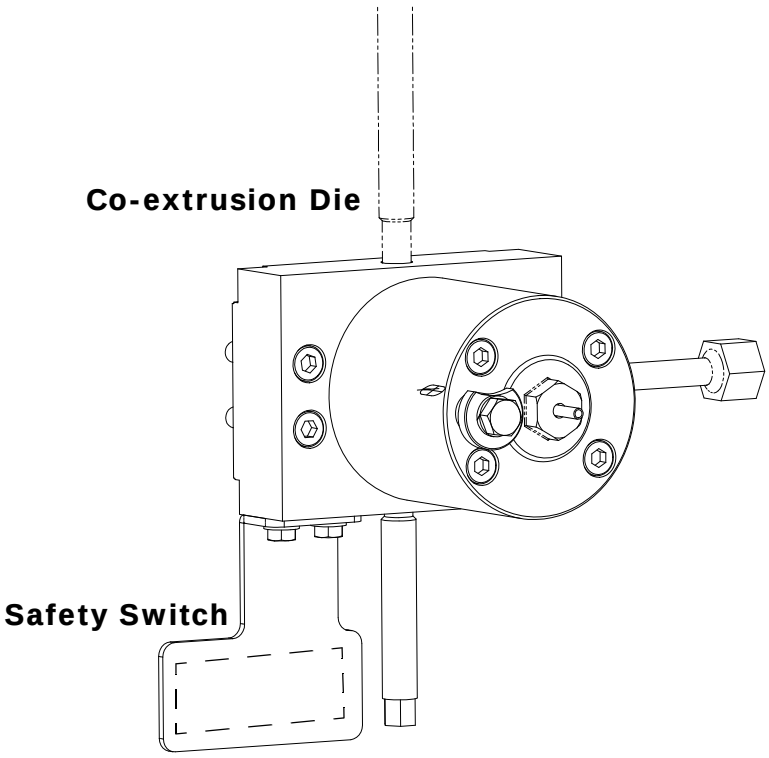
This closed loop system requires treated water - See “Barrel Cooling Unit” on page 56.)

12 Co-extrusion Die

This is an optional assembly used to form a single or multi-streams of product that can be injected with such as cream. No product cutter is used with this type of die; other die configurations are also available.

To operate, the extruder must have one of the following safety interlocked components fitted at the barrel end:

- The Cutter Assembly
- Co-extrusion Die
- Washout Chute.



The flow of cooked extrudate is controlled in such a way that it forms an annulus around the cream injection tube before it emerges from the die outlet and expands to form a solid tube. A continuous stream of product is formed. A transducer is fitted to measures both pressure and temperature. The stream of filled product is fed onto the Pillow Crimper for crimping.

Removing The Cutter Die

- See also Product Cutter

1 Release the locking handwheel securing the cutter assembly onto the extruder barrel and swing it to the side clear of the barrel end.

2 Remove the pressure transducer.

3 Release the four cap head screws and remove the die assembly from the extruder.

4 Lift the die assembly clear of the extruder.

5 Clean the end of the barrel, ensure all mating faces are clean.

Fitting The Co-extrusion Die

The co-extrusion die assembly is bolted directly onto the end of the extruder barrel.

1 Lift and locate the complete co-extrusion die onto the end of the extruder barrel.

2 Refit and tighten the four capscrews.

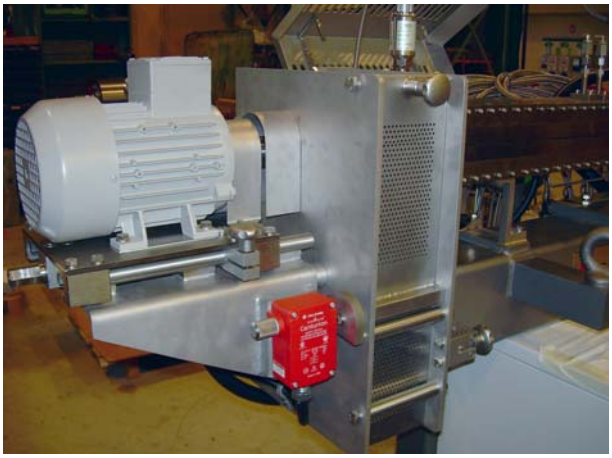
3 Start the cream hopper and circulate cream, returning it back to the cream hopper to ensure the flow an the consistency are OK. The extruder should be producing stable and suitable product.

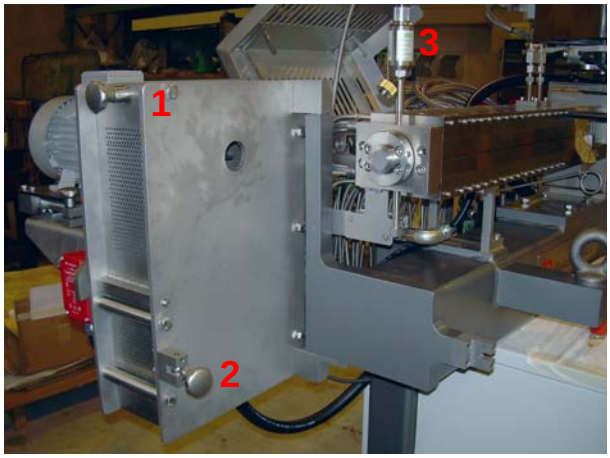
4 When cream is being pumped to the end of the die connection pipe, briefly stop the cream pump.

5 Quickly fit the cream connection to the co-extrusion die and restart the pump.

6 The co-extruded product will noe be produced.

13 Product Cutter





An integrated Product Cutter is fitted at the discharge end of the MPF24. The assembly is fitted on a pivoting frame, allowing easy access to the die. A single hand wheel **2** locks the cutter frame in place over the die, which can be quickly un-done to swing the assembly away from the die. A safety interlock ensures the cutter cannot run if in the open position. Access the the cutter for cleaning or maintenance is via an interlocked drop down side cover **1**. The pressure transducer **3** must be fitted when using the cutter die.

The cutter face can be accurately set against the die to the required clearance. The gap is adjusted by turning the hexagonal shaft under the cutter drive motor.

On production, as the direct expanded product emerges from the die, it can be cut to length by the high speed rotating cutter. The speed of rotation of the cutter will determine the length of the product. Set the required cutter speed via the extruder HMI screen.

A two blade cutter is supplied as standard. Knife assemblies with 1 to 4 blades may be supplied depending upon the number of cuts needed per second, the blades are available in a rigid or flexible form.

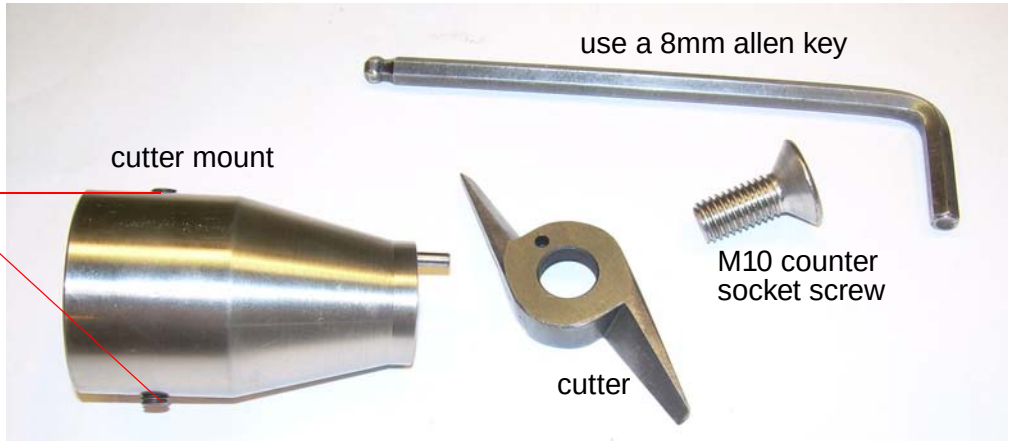
The Face Cutter comprises a cutter knife bolted to a cutter mount, this bolts to a cutter adaptor on the cutter motor drive shaft. The cutter is driven by a 0.55kw cutter motor.

Access to the cutter blade is via an interlocked hinged guard. When this is opened, or the motor or the cutter assembly is un-bolted and swung away from the extruder die face - the power supply to the cutter motor is disconnected.

WARNING BE AWARE THAT THE EXTRUDER WILL CONTINUE TO DISCHARGE HOT PRODUCT. KEEP WELL CLEAR OF THE AREA AROUND THE EXPOSED DIE.

Cutter Removal

Cutter Components



1 Undo the cutter assembly clamping handwheel and swing the assembly away from the die face. Undo the cutter drop down side cover. The electrical interlock switches ensure that the power is now disconnected to the cutter drive.

The cutter can be removed on its own or still secured to the cutter mount.

2 First wind the motor to the fully back position.

3 To remove the cutter on its own; release and remove the M10 counter socket screw. Lift the away the cutter and screw:

4 To remove the mount and cutter together - release the two grub screws holding it on the motor shaft:

5 Lift the away the cutter mount and cutter.

6 Visually inspect the cutter blades for wear. If any damage can be seen, it may not be rectified by lightly re-grinding the cutter blades. To sharpen a worn cutter, re-grind the land to restore the cutting edge. If seriously damaged, a replacement should be ordered from Baker Perkins.

7 To replace the cutter/mount, reverse the above steps.

CAUTION *It is important that the grub screw are aligned with the flats on the adaptor shaft before they are tighten.*

TIP Baker Perkins recommend that a spare cutter is stocked as a consumable item.

8 Ensure that the mating faces are clean.

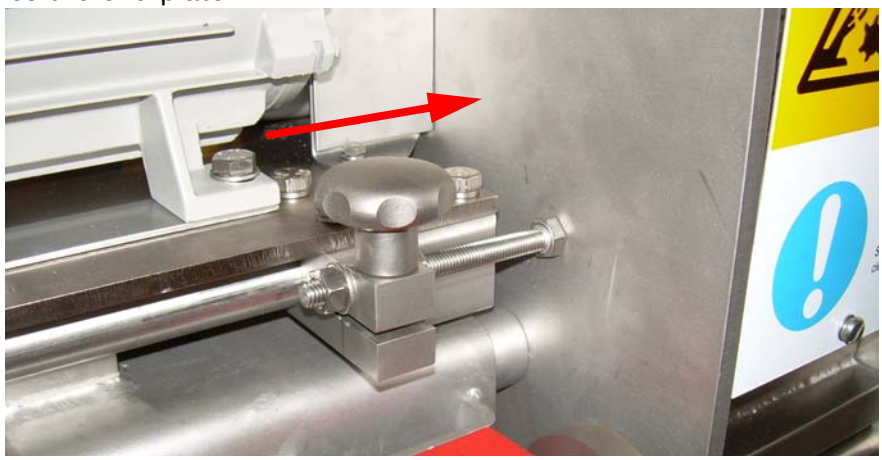
9 If the cutter mount is being replaced - take care to align the grub screws with the flats on the cutter adaptor (see previous photo).

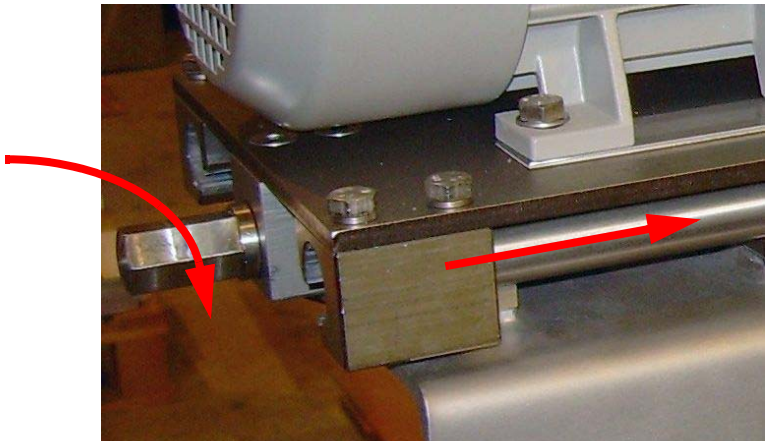
CAUTION *The cutter should always be left at least 1mm clear of the die face until production starts. DO NOT WIND THE CUTTER HARD AGAINST THE DIE FACE - SERIOUS DAMAGE TO THE DRIVE MOTOR WILL OCCUR.*

Setting the Cutter end stop relative to the Die face

1 Ensure that the die has been cleaned ready for production.

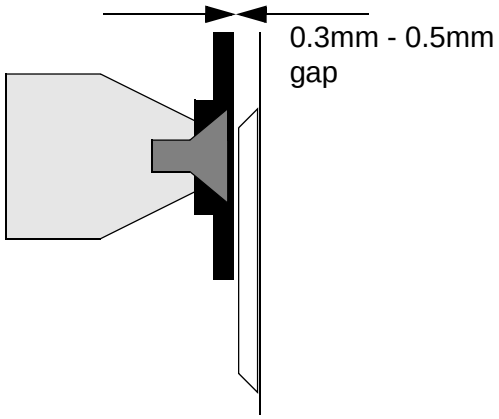
2 Release the stop block and gently turn the hexagonal shaft under the cutter drive motor to move the cutter towards the die face until the end stop reaches the end plate.





CAUTION *The cutter MUST NOT be wound against the die face, leave a small gap (1mm) so that the cutter and die are not damaged.*

3 Adjust the end stop until the cutter is between 0.3mm to 0.5mm clear of the die face.



4 Lock the end stop with the handwheel.

5 Each time the cutter is closed, this procedure (steps 2 - 4) must be repeated.

14 General MPF24 Information

Water Temperature

The barrel cooling unit should be set to give 15ºC at 26 litres/minute. The chilled water supply should be set at 5º C at 26 litres/minute.

How long can I run it empty?

For the absolute minimum time - NEVER AT HIGH SPEED! See “Extruder Barrel (Discharge End)” on page 59 for info on agitator lubrication.

Can the MPF24 be run without the Cutter in position?

Yes - the MPF24 Extruder is designed for this function; if non cut extruded product samples are required. Also, at startup and to empty and clean the barrel if required.

The feeder can also be run when it is swung away from the extruder - but the extruder main drive will not operate.

The extruders drive trips out on overload with product in?

- Torque Meter @ 100% = Normal
- Torque Meter @ 105% = Torque meter flashes & audible alarm sounds
- Torque Meter @ 120% = *follow steps below.....*

1 The extruder main drive stops, the feeder stops

2 Press the Torque Overload Reset (Red) illuminated pushbutton

3 Press the Silence Audible Alarm (Yellow) illuminated pushbutton

4 Press the E-Stop/Alarm Reset (Blue) illuminated pushbutton

5 Restart is possible but unlikely

6 Increase the temperature of zones 5, 4 and 3

7 When the temperature comes up - restart the extruder main drive AT SLOW SPEED. Gradually increase the speed, observing the torque on the HMI screen.

8 When good product is flowing, wind the cutter back towards the die to obtain a good cutting action.

Product "bridges" at infeed to barrel?

This is a process problem - reducing the product throughput should help to reduce this problem.

CAUTION ***AT YOUR OWN RISK:*** *A piece of round nylon bar (about 25mm diameter) can be used as a "ram" to push a blockage down the feed funnel.*

15 Operator Settings & Controls

WARNING BEFORE OPERATING YOUR BAKER PERKINS MPF24 EXTRUDER, READ THE SECTION ON SAFETY. ALL OPERATORS MUST BE FULLY AWARE OF ALL THE FUNCTIONS OF THIS MACHINE AND ITS SAFETY FEATURES.

CAUTION *Do not try to run the extruder if product is blocked, open the barrel and clean the agitators and shafts.*

MPF24 On-Machine Operator Facia

The above on-machine operator control station is fitted with an Allen Bradley PanelView 1500P touch screen HMI (Human Machine Interface) on a movable arm that allows the facia to turned to suit the operator position.

A USB connection is fitted to the bottom right of the screen for connection to a PC.

The Main Power Isolator is on the front of right side control panel door. A Red Beacon and Audible Sounder is fitted to the panel to alert users of system alarms. This section should be read in conjunction with:

- “Operating the Extruder” on page 93
- “Process Instructions” on page 99

Emergency Stop (Red) Push-button

TIP

1 on control facia
1 on fitted control panel

The E-Stop push-button displays an alarm on the HMI screen when pressed/released - until the Reset below is pressed and the alarm acknowledged on the HMI.

Power On (White) Lamp

After the control panel is turned on the system initiates and the screen on page 76 is displayed.

Alarm Features

Note

Always check the physical condition that caused the alarm and take the appropriate action as required.

When an alarm occurs, the klaxon will sound to alert the operator's attention and the Alarm icon on the HMI screen flashes.

1 Check and clear any physical alarm conditions such as a guard is part open.

2 Press the  key on the HMI and acknowledge the alarm.

3 Press the  silence audible alarm key on the HMI screen.

4 Press the  key to reset the system.

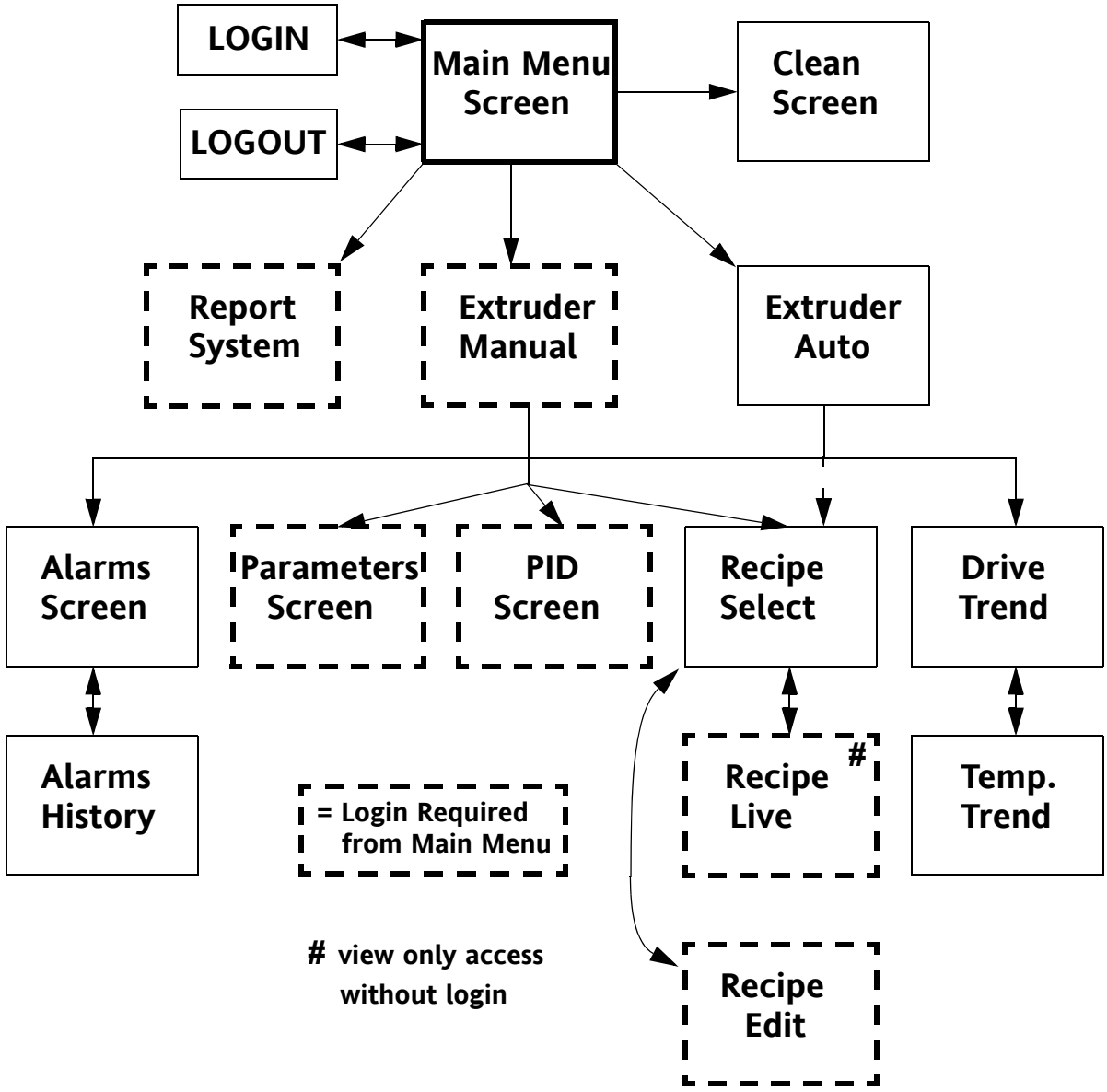
Typical example:

- 105% High Torque Alarm

When the 105% torque situation on extruder occurs; the extruder and feeder will stop, the klaxon will sound, Alarm on HMI screen (silencing the alarm will only stop the klaxon).

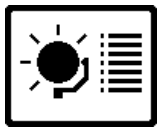
See System Alarms for a complete list of all alarms that may be displayed.

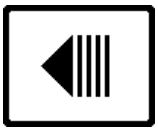
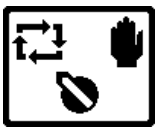
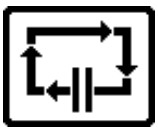
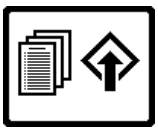
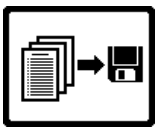
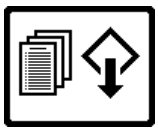
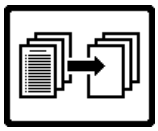
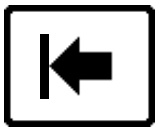
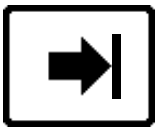
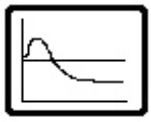
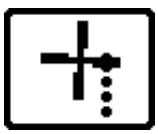
15.1 Screen Navigation

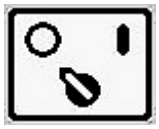


15.2 Screen Icon Table

Any keys (onscreen icons) not shown here will be detailed with the HMI screen they are used on. Some icons may not be applicable to your extruder.

	Silence alarm		Alarm Flashing red = active alarm		Move cursor down list
	Move cursor up list		Reset alarm		Alarm History Screen

	Next screen		Previous screen		Go to Main Menu Screen
	User Login		Clean Screen		Parameters Screen
	Start sequence Extruder in Auto mode. (The device selected in Manual mode.)		Stop sequence Extruder in Auto mode. (The device selected in Manual mode.)		System Mode Auto or Manual toggle
	Pause / Hold sequence in auto mode		Recipe Select Screens		Upload recipe from the PLC
	Save recipe		Download recipe from the PLC		Recipe Edit Screen
	Delete recipe		Recipe "Save-as"		Move cursor point to left
	Move cursor point to right		Move cursor to end of display		Move cursor to start of display
	PID Screens (on Parameters screen)		Graph Screens (drive 1st, then temperature next)		Heating / Cooling control
	Fast cool		Lubrication control		Die pressure transducer setting
	Torque at 105% ACTION REQUIRED		Cutter control		Liquid (1&2): start or stop in manual mode

	Exit Extruder System to AB Panelview		PLC codes		System Users
	Selected device Off/On		Report System screen		

TIP

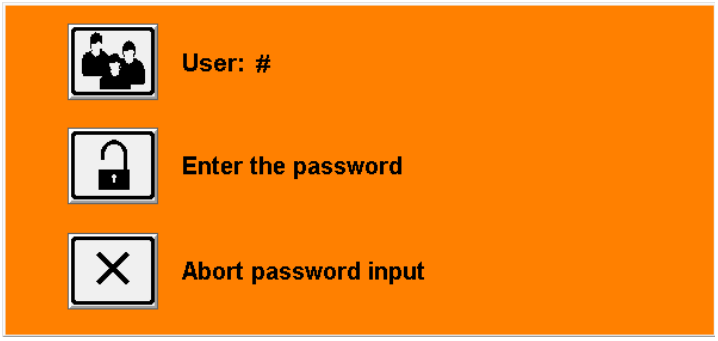
If a device has been started, the function key/device is displayed Green; if stopped it is Grey (or not available), if the device is faulted it is then Red. Some icons are not displayed until an event occurs (such as toque getting high).

Login Procedure

Security on this extruder is disabled

The extruder can be operated with the pre-programmed recipes without user login for normal production. Icons (keys) will not be available for protected functions. To change recipes, settings and parameters login is required at "Engineer" or "Supervisor" level.

1 From the Main Menu, touch the User Login key to display the popup window:



2 Touch the "User" icon to display a popup keyboard and enter a configured username and press the OK key.

3 Touch the "Enter the password" icon, use the popup keyboard to enter the corresponding Password and press the OK key.

4 The User will now be logged in  , this means a User has logged out 

TIP

If a screen key is "greyed out" - it is not available to use. This is usually because a user has not logged in, then only the preset recipes and profiles are available.

● RED = E-Stop pressed or safety device operated

Status Bars

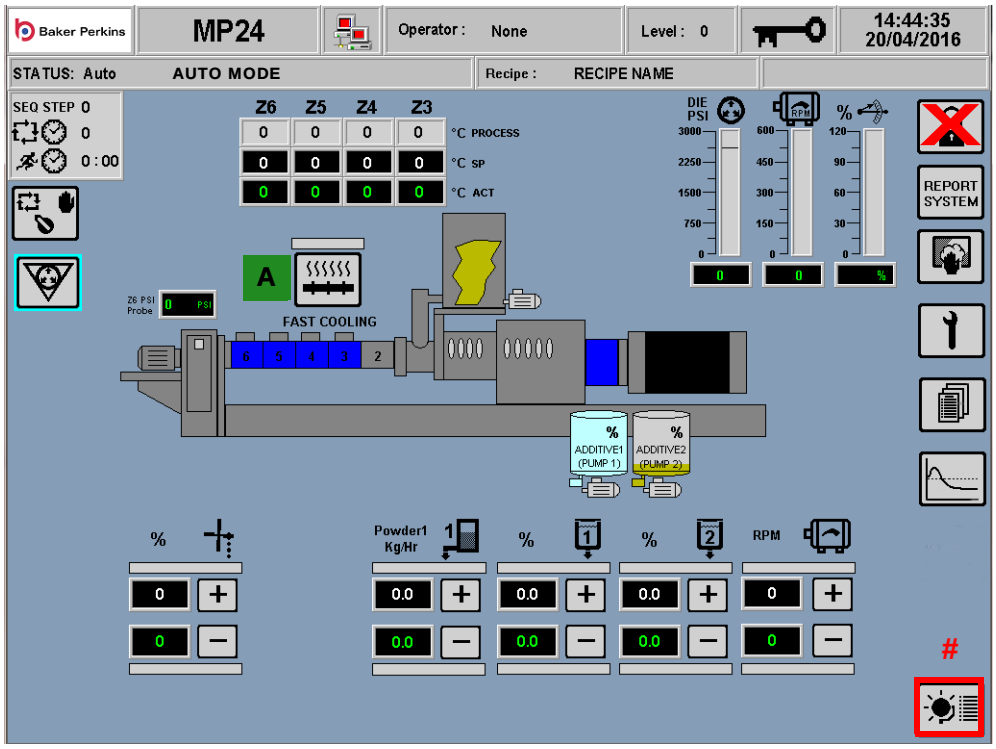
These are displayed above function icons:

grey = idle	green = running	yellow = running reverse	flashing red = faulted

After the power is turned on and the extruder control system has initiated, the following screen is displayed.

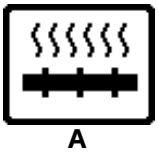
15.3 Main Auto Control Screen

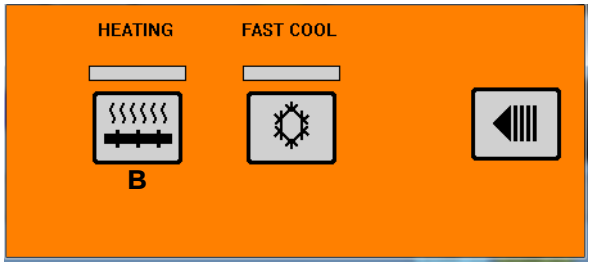
This is the main Auto/Manual control screen for the extruder. It has function and adjustment keys to select other screens, select devices to control speeds and temperatures. Any current alarms that are active will be indicated on the HMI screen by the flashing red Alarm # icon. These must be acknowledged and cleared.



1 The extruder can be operated from this screen without user login.

2 First touch the heating key (**A**) to display the control popup:

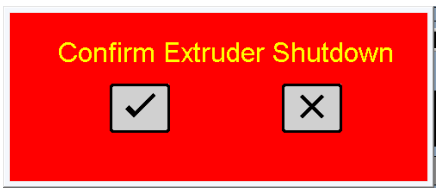




3 Then start the heaters (**B**).

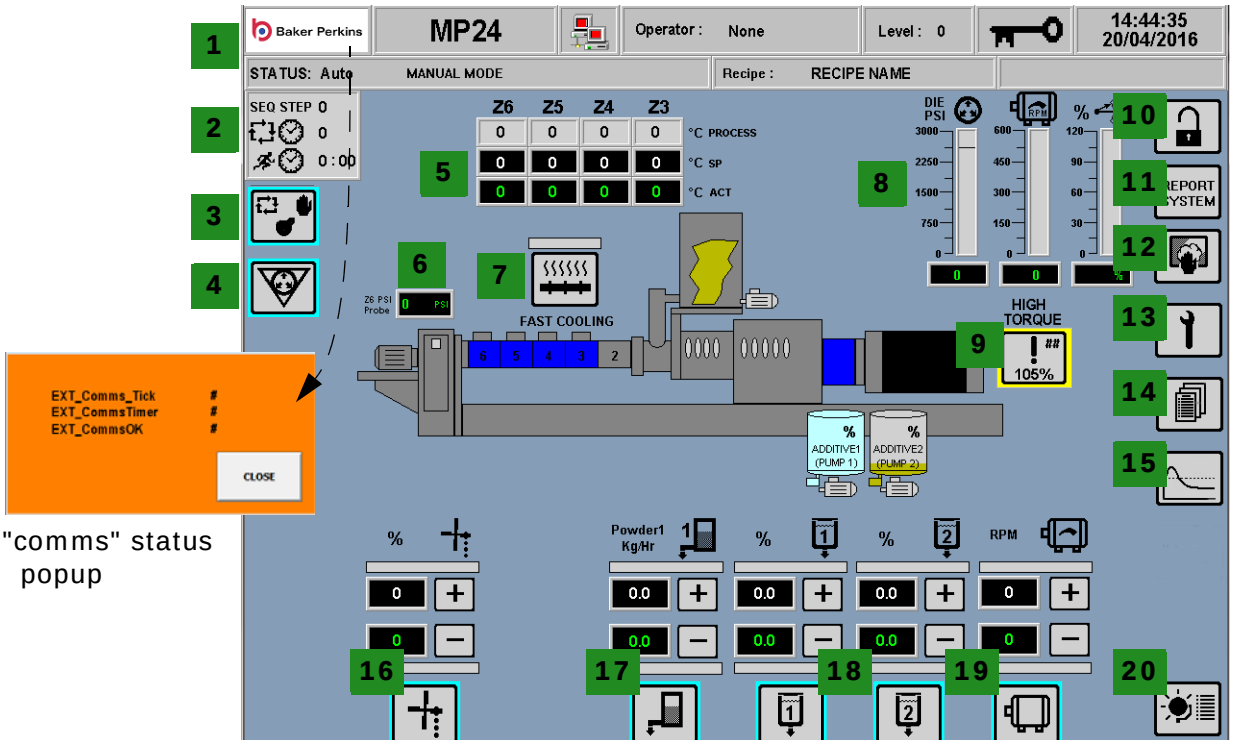
4 It will take approximately 15 minutes for the barrel to reach temperature setpoint, then the Auto keys will be displayed and the Start can be pressed:

- Auto Start - start recipe sequence
- Auto Stop - with confirm popup:
- Pause the auto sequence - press again to re-start.



See also "Auto Starting The Extruder" on page 89.

15.4 Manual Control Screen



"comms" status popup

Displays & Function Keys

1 Screen Name, Recipe Name, Operation Mode, Operator (logged in), Login Status, Date & Time.

2 System timers:

- Step: 1 - 4 = startup, 5 = running, 6 - 9 shutdown
- Time remaining at current step
- Total time at step.

3 Auto or Manual Mode selector.

4 Die pressure - press to zero.

5 Barrel zone temperatures - actual & setpoint.

6 Die pressure display.

7 Heating\Cooling control.

8 Die PSI, main drive speed & torque displays.

9 Extruder torque 105%

- in Auto - reduces power by 10% every 30 seconds
- in Manual - every press reduces power by 10%.

10 User Login - see Login Procedure (disabled).

11 Display the Report System screen as shown on page 92.

12 Display the "Clean screen" as shown on page 86.

13 Display the Engineers Parameter screen as shown on page 83.

14 Display the Recipe screens as shown on page 78.

15 Display the Trend screens as shown on page 82.

16 Cutter select & speed - increase / decrease.

17 Powder Feeder select & speed - increase / decrease.

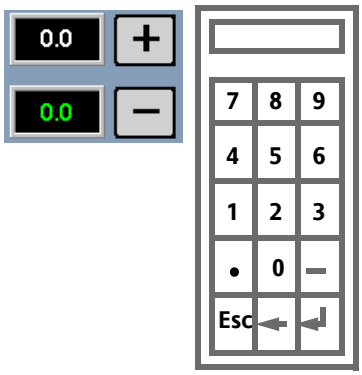
18 Liquid Tanks 1 & 2 select & speed - increase / decrease.

19 Main Drive (agitators) select & speed - increase / decrease.

20 Display Alarms screen shown on page 85.

Device Adjustment

Device setting values can be adjusted by touching the +/- keys, example on the right.

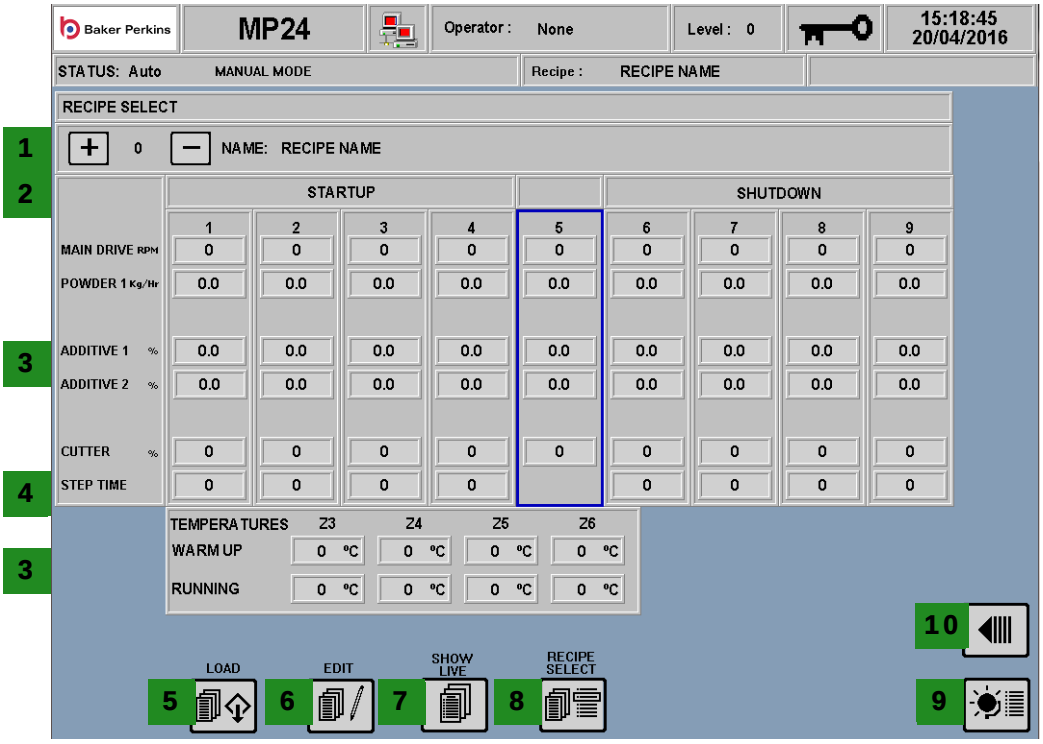


- Top field - preset (the parameter you change)
- Bottom field - actual current speed or setting display.

Direct Number Input

If a specific parameter value is to be entered (instead of using the +/- keys), touch the field to display a popup number pad. Use to enter the required parameter.

15.5 Recipe Select Screen



TIP

You cannot load a new recipe when the extruder is running a recipe. You can select a different recipe to edit whilst the current recipe is running.

1 Recipe Select

- Use the +\- to select the recipe you would like to display on the HMI.

2 Step Sequence

- The sequence comprises of 3 sections:
  1 - 4 Startup, 5 Run, 6 - 9 (shutdown).

3 Extruder Device Parameters

- The parameter settings for each of the devices shown are displayed in these fields.

4 Step Time

- The step point times for each of the devices shown are displayed in the fields displayed.

5 Recipe Load

- Loads the recipe number displayed into the PLC.

6 Recipe Edit Screen

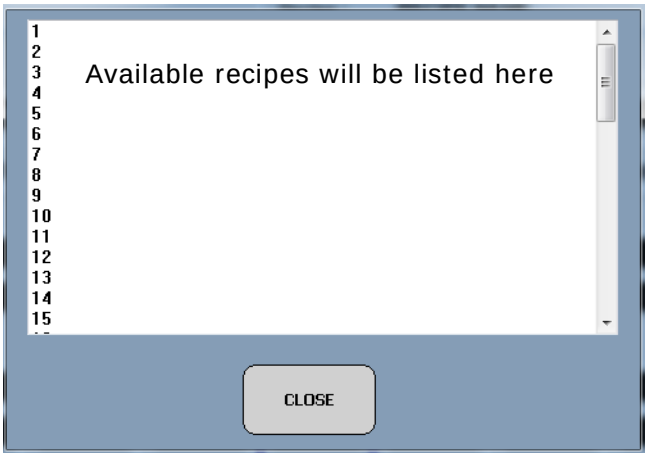
- Use this screen to edit any of the recipe parameter fields. Touch the required field, enter a new parameter on the popup number pad. The recipe can then be saved or given a new name - press the Save Recipe key.

7 View Running Recipe

- View the Recipe Live Screen detailing the settings currently running on the extruder.

8 Recipe Select Popup

- This is an alternative way to display and select a recipe:

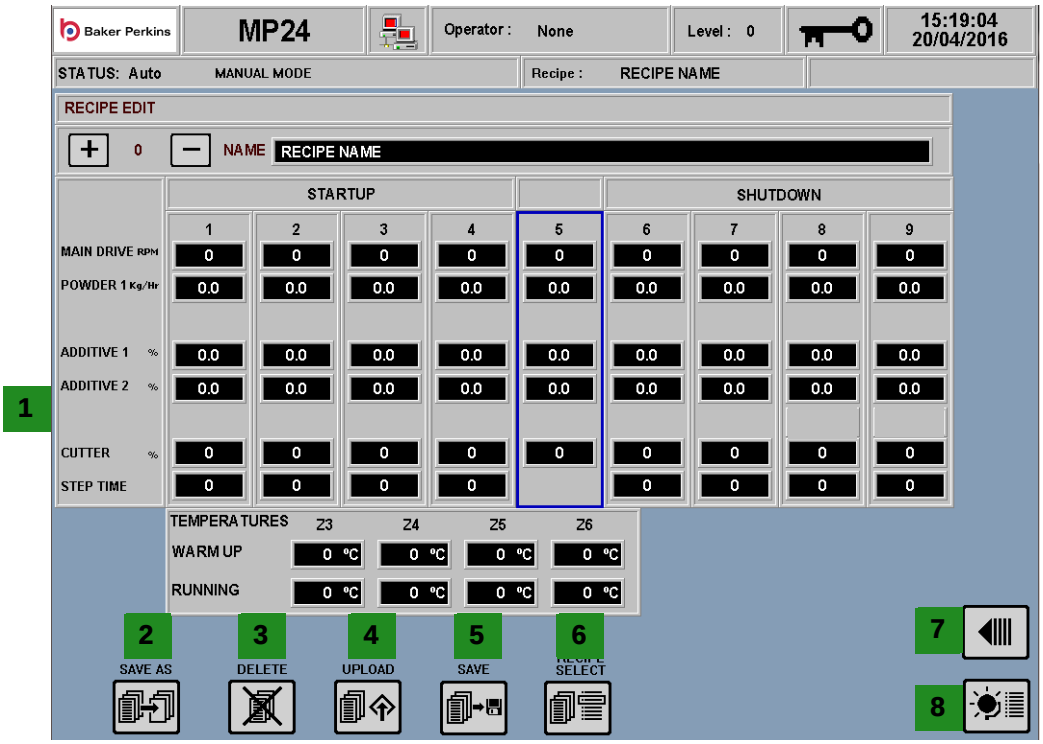


Touch the recipe to select, then touch close.

9 Display the Alarm Screen

10 Display the Main Auto Control Screen.

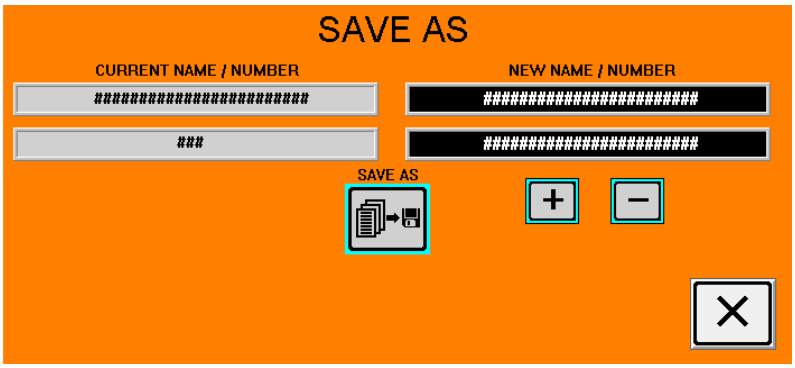
15.6 Recipe Edit Screen



1 Device Step Setting Fields:

- Main drive speed RPM
- Feeder rate %
- Additive 1&2 rate %
- Cutter speed %
- Step time (second)
- Warmup ºC.
- Zone temperatures ºC

2 Recipe "save-as" key:



3 Recipe delete key, a confirm popup is displayed.

4 Recipe load to PLC.

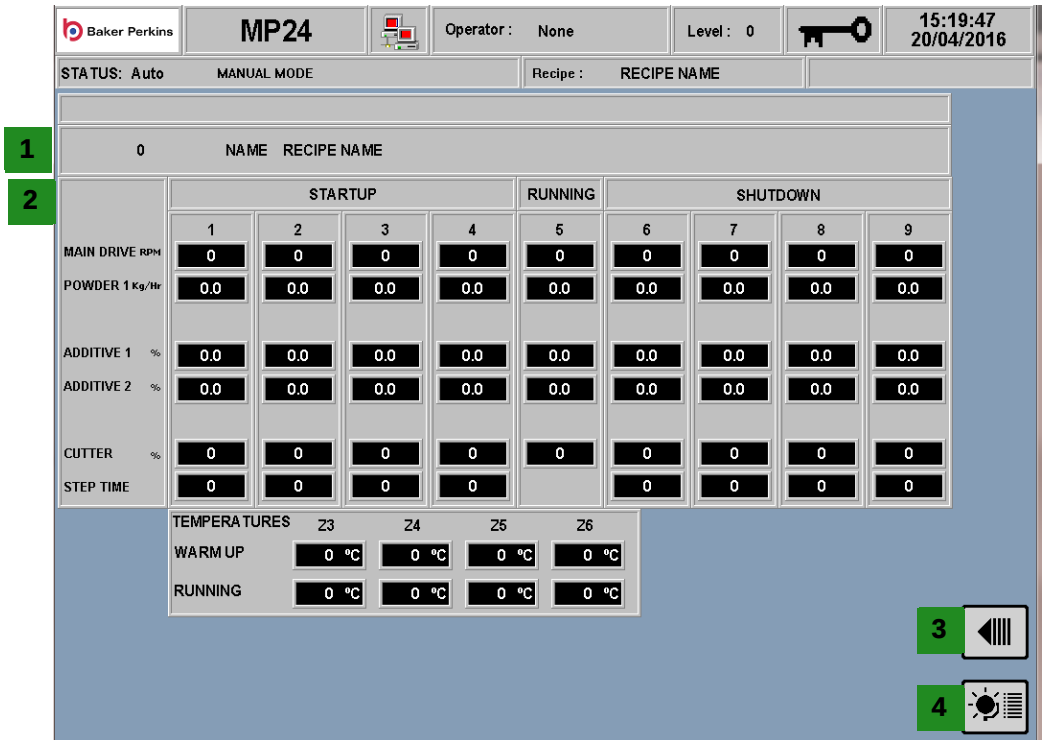
5 Recipe save.

6 Recipe select popup.

7 Display the Main Auto Control Screen.

8 Display the Alarm Screen.

15.7 Recipe Live Screen



The parameter fields on the Live Recipe screen can be temporarily changed "on the run" but are not saved.

1 Current live recipe number and name.

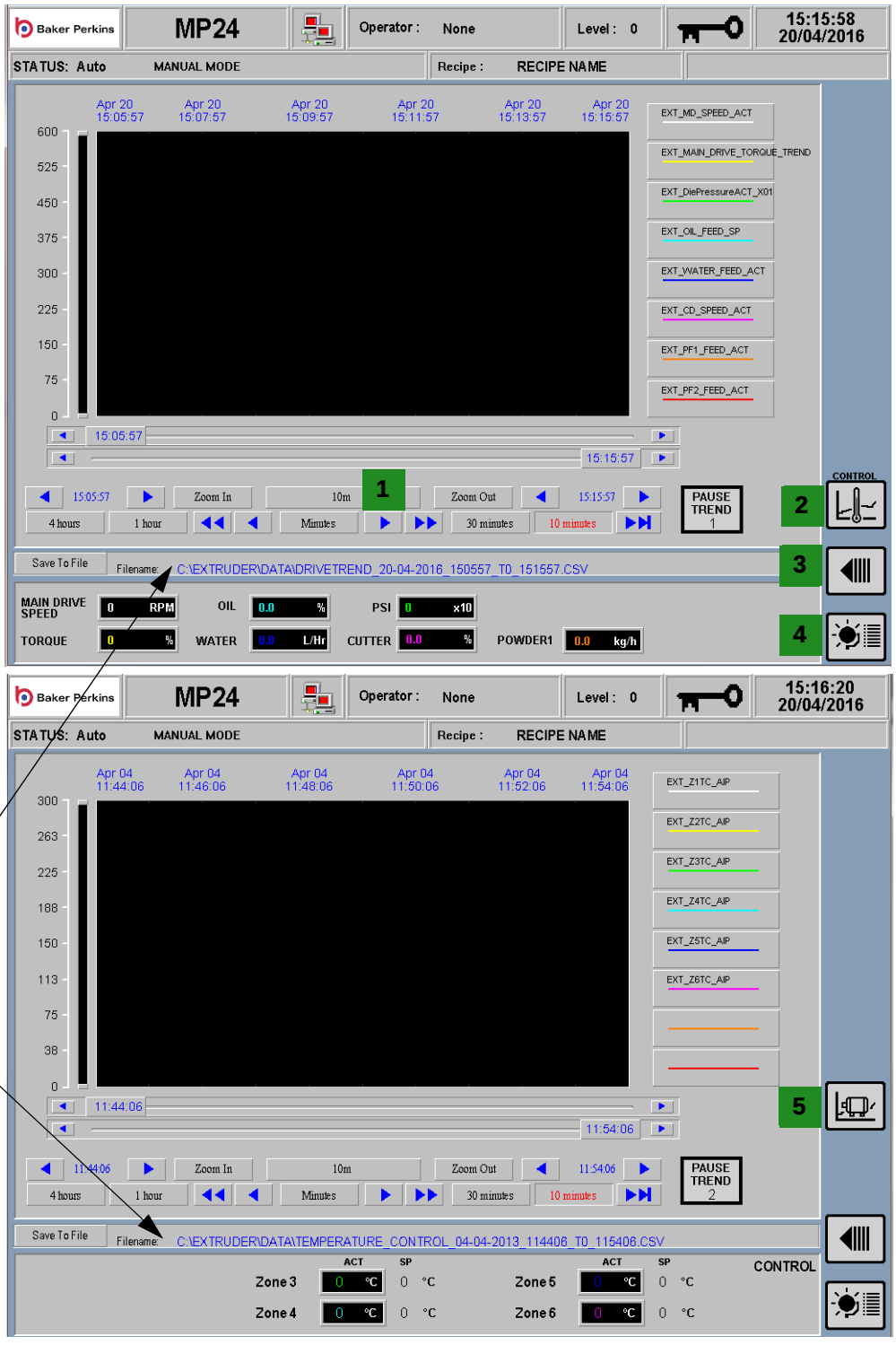
2 Step Sequence for devices

- The sequence comprises of 3 sections:
  1 - 4 Startup, 5 Run, 6 - 9 (shutdown).

3 Display the Main Auto Control Screen.

4 Display the Alarm Screen.

15.8 Trend Screens



Path is now:
E:\Trends
("E" is the USB)

The Drive Trend screen for the extruder is shown at the top, the Temperature Trend screen (at the bottom) has the same layout and functions.

1 Navigation

- Use the Move Left/Right, End and Home keys to display the setpoint and actual graph section of the time line required.

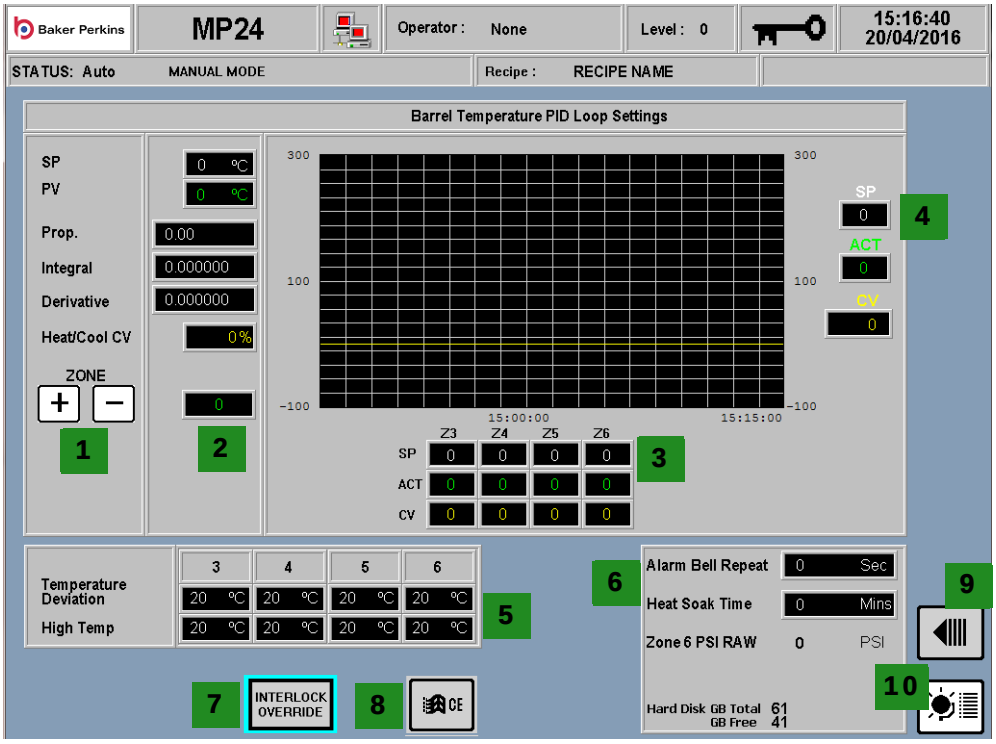
2 Display the Temperature Trend Screen.

3 Display the Main Auto Control Screen.

4 Display the Alarm Screen.

5 Display the Drive Trend Screen.

15.9 Parameters Screen



This is the parameters screen for the extruder. It has function and adjustment keys to set the PID, select other screens, select devices to control speeds and temperatures.

1 Use the +\- keys to select the barrel zone PID to display.

2 Zone selected fields.

3 Setpoints and readings for heated zones.

4 Setpoints for selected zone on (2).

5 Zone temperatures deviation and high temperature setpoints.

6 Alarm repeat setpoint\heat soak time setpoint, general info.

7 Interlock Override - touch this key to run the feeder and pumps without the extruder running.

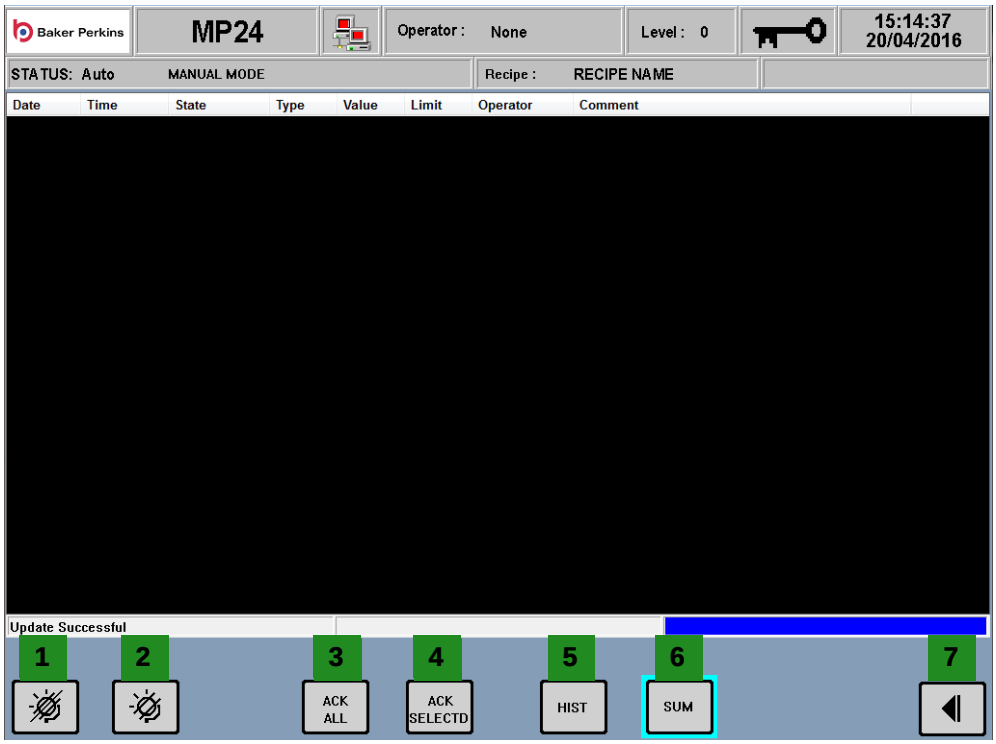
8 Exit the extruder system to Windows CE

9 Display the Main Auto Control Screen.

10 Display the Alarm Screen.

BLANK FOR FUTURE USE

15.10 Alarm Screen



The above screen displays a list of all alarm activity on the extruder system. Touch the HIST key to display the Alarm History screen. All alarm logs are removed from the History screen at system shutdown ?????.

1 Silence alarm.

2 Reset alarm.

3 Acknowledge all alarms on list.

4 Acknowledge selected alarms.

5 Display the similar Alarm History screen.

6 SUM ????

7 Display the Main Auto Control Screen.

15.11 Clean Screen

From the Main Auto Control Screen, use the Clean Screen key when the HMI is in use to clean the screen.

Use the **X** key to revert back to the Extruder Main Menu.

CAUTION *Use only a PC screen wipe or a clean damp cloth to wipe the screen - pressure washing, abrasive, caustic or acid cleaner will damage the screen.*

System Alarms

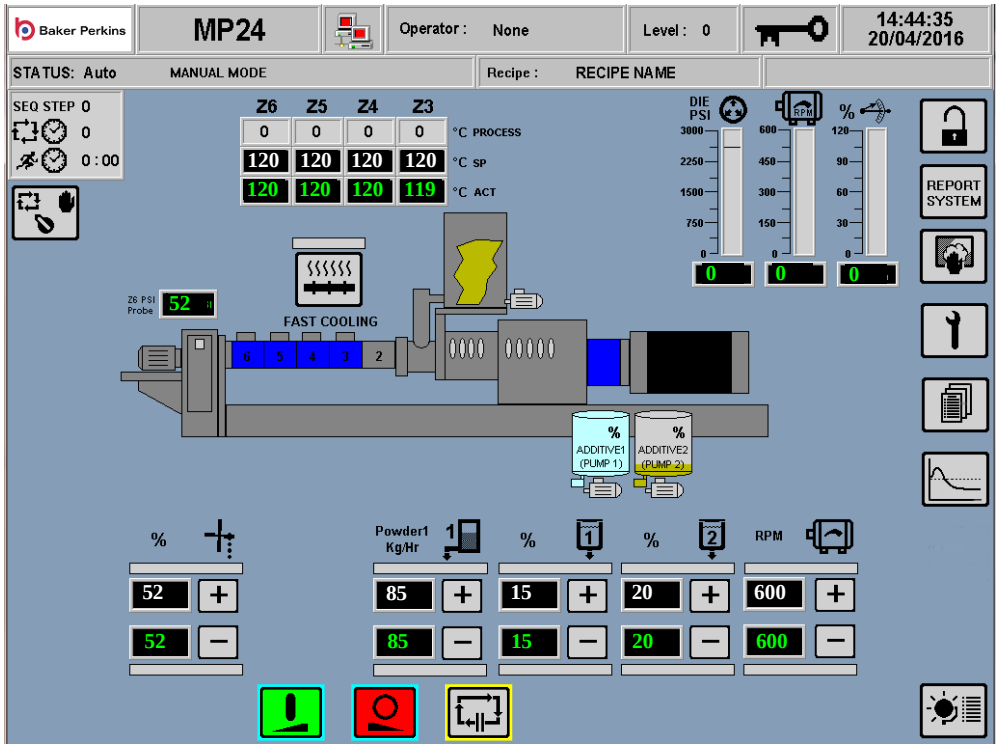
(001) EMERGENCY STOP RELAY ACTIVATED	(052) ZONE 4 HIGH TEMPERATURE
(002) CONTROL PANEL ESTOP BUTION PRESSED	(053) ZONE 5 HIGH TEMPERATURE
(003) ESTOP PRESSED MACHINE FRONT	(054) ZONE 6 HIGH TEMPERATURE
(004) SPARE	(055) SPARE - CUTTER AIR FAN MCB TRIPPED
(005) MDSR MAIN DRIVE SAFETY RELAY ACTIVATED	(056) SPARE - CUTTER AIR FAN INVERTER FAULT
(006) SPARE - FEEDER NOT IN POSITION	(057) SPARE - FEEDER NOT IN POSITION
(007) FEED TUBE/DIE BLOCK SAFETY RELAY TRIPPED	(058) LIQ3 - ADDITIVE INVERTER MCB TRIPPED
(008) DIE BLOCK/CHUTE NOT IN POSITION	(059) SPARE
(009) BARREL OPEN LIMIT SWITCH	(060) LIQ1 - WATER PUMP NOT RUNNING
(010) TORQUE COVER SAFETY SWITCH OPERATED	LIQ2 - ADDITIVE PUMP NOT RUNNING
(011) FEED TUBE 1 NOT IN POSITION	(062) SPARE - LIQ 3 - ADDITIVE PUMP NOT RUNNING
(012) STUFFING BOX SAFETY SWITCH 1 OPERATED (FRONT)	(063) SPARE - LIQ 3 - ADDITIVE PUMP INVERTER FAULT
(013) STUFFING BOX SAFETY SWITCH 2 OPERATED (REAR)	(064) SPARE
(014) WATER TANK LOW LEVEL	(065) SPARE - LUBE PUMP NOT RUNNING/MCB TRIP
(015) ADDITIVE 1 TANK LOW LEVEL	(066) SPARE - CUTTER MOTOR THERMISTOR TRIPPED
(016) POWDER FEEDER LOW LEVEL WARNING	(067) POWDER FEEDER 1 ALARM / RUNNING FAULT
(017) CUTTER SAFETY RELAY TRIPPED	(068) SPARE-TORQUE LIMITTER TRIPPED (PROXY SWITCH)
(018) CUTTER NOT IN POSITION	(069) SPARE - LUBE OIL LOW FLOW
(019) CUTTER GUARD NOT IN POSITION	(070) SPARE - LUBE OIL HIGH TEMPERATURE
(020) ADDITIVE 2 TANK LOW LEVEL	(071) SPARE
(021) SPARE	(072) HEATING TURNED OFF
(022) WATER LOW FLOW WARNING	(073) MAIN DRIVE RUNNING - MODE CHANGE NOT AVAILABLE

(023) WATER LOW FLOW SHUTDOWN	(074) POWDER FEEDER RUNNING - MODE CHANGE NOT AVAILABLE
(024) SPARE - LIQUID 2 LOW FLOW WARNING	(075) CUTTER RUNNING - MODE CHANGE NOT AVAILABLE
(025) SPARE - LIQUID 2 LOW FLOW SHUTDOWN	(076) LIQUID RUNNING - MODE CHANGE NOT AVAILABLE
(026) ZONE 1 HEATER MCB/ ELCB TRIPPED	(077) CANNOT START FEEDER WITHOUT MAIN DRIVE RUNNING
(027) ZONE 2 HEATER MCB/ ELCB TRIPPED	(078) CANNOT START CUTTER WITHOUT MAIN DRIVE RUNNING
(028) ZONE 3 HEATER MCB/ ELCB TRIPPED	(079) CANNOT START LIQUIDS WITHOUT MAIN DRIVE RUNNING
(029) ZONE 4 HEATER MCB/ ELCB TRIPPED	(080) CANNOT LOAD RECIPE WITH AUTO SEQUENCE RUNNING
(030) MDMCB MAIN DRIVE MCB TRIPPED	(081) MAIN DRIVE 105% OVER TORQUE WARNING
(031)LIQ 1 - WATER PUMP INVERTER FAULT	(082) MAIN DRIVE 120% OVER TORQUE SHUTDOWN
(032)LIQ 2 - ADDITIVE PUMP INVERTER FAULT	(083) DIE PRESSURE WARNING > 2000 PSI
(033) MAIN DRIVE HEALTHY RELAY	(084) DIE PRESSURE SHUTDOWN > 2500 PSI
(034) POWDER FEEDER 2 FAULT	(085) PLC BATTERY LOW/ FAULTY
(035) CUTTER DRIVE HEALTHY RELAY	(086) PROCESS I DIE THERMOCOUPLE FAULT
(036) MAIN DRIVE FAILED TO START	(087) SPARE
(037) POWDER FEEDER 1 MCB TRIPPED	(088) SPARE
(038) CUTTER INVERTER MCB TRIPPED	(089) SPARE - ZONE 1 HEATER THERMOCOUPLE FAULT
(039) LIQ 1 - WATER INVERTER MCB TRIPPED	(090) SPARE - ZONE 2 HEATER THERMOCOUPLE FAULT
(040) LIQ 2 - ADDITIVE INVERTER MCB TRIPPED	(091) ZONE 3 HEATER THERMOCOUPLE FAULT
(041) ZONE 1 TEMPERATURE DEVIATION	(092) ZONE 4 HEATER THERMOCOUPLE FAULT
(042) ZONE 2 TEMPERATURE DEVIATION	(093) ZONE 5 HEATER THERMOCOUPLE FAULT
(043) ZONE 3 TEMPERATURE DEVIATION	(094) ZONE 6 HEATER THERMOCOUPLE FAULT

(044) ZONE4 TEMPERATURE DEVIATION	(095) SPARE - CUTTER CAGE DOOR 1 NOT CLOSED (FRONT)
(045) ZONE 5 TEMPERATURE DEVIATION	(096) SPARE - CUTTER CAGE DOOR 2 NOT CLOSED (REAR)
(046) ZONE 6 TEMPERATURE DEVIATION	(097) SPARE - CUTTER SPINDLE GUARD NOT FITTED
(047) ZONE 5 HEATER MCB/ ELCB TRIPPED	(098) SPARE - CUTTER ROTATION MONITOR MCB TRIPPED
(048) ZONE 6 HEATER MCB/ ELCB TRIPPED	(099) SPARE - CUTTER PLUG NOT FITTED
(049) ZONE 1 HIGH TEMPERATURE	(100) BARREL EXTENSION - HEATERS PLUG NOT FITTED
(050) ZONE 2 HIGH TEMPERATURE	(101) BARREL EXTENSION - THERMOCOUPLE PLUG NOT FITTED
(051) ZONE 3 HIGH TEMPERATURE	(102) SPARE.

>>>>go to alarm (052)

15.12 Auto Starting The Extruder



Note

Make sure the barrel cooling unit is turned on before starting the extruder. If the extruder temperature exceeds the setting on the parameters screen - it will automatically shut down.

The above screen shows example settings that can be used initially until you establish what is best for your products.

Startup Procedure

1 Check that any ancillary equipment is ready to deliver ingredients to the feeder and all upstream and downsteam systems are ready.

2 Check that liquids are available in the liquid tanks and the feed valves are open.

3 Ensure that the extruder has been assembled correctly using the correct torque settings.

4 Check the screw elements have been correctly assembled on the agitator shafts and the shaft screw tips have been tightened to the correct torque.

5 Use a spanner to rotate the agitator shafts slowly in a clock-wise direction. Check for tight spots. If tight spots are detected, stop the shafts in that position and investigate the problem.

6 Fit the required die and torque to the prescribed torque settings.

7 Check the cutter assembly is ready for production (if it is to be used). Secure in place over the die.

8 Ensure all equipment after the Extruder is ready to receive product.

9 Ensure that the feed tube is secured in place and the powder feeder is ready.

10 Place a suitable scrap bin at the outlet of the cutter\die to catch the preliminary product during start-up.

11 Check all personnel are clear of the extruder - turn on the power isolator. After system initiation, the **Main Menu** screen will be displayed on the operator HMI.

12 Plug in the die pressure probe (if not already fitted) and check the die pressure reading is close to zero. Keys: **Main Menu** > **Die Pressure**, then zero the die pressure.

13 Check the **Alarms** screen - physically check the alarm problem (such as guard part opened) and reset any faults that are present.

14 Before operating the Extruder, it is necessary to download a recipe. After downloading the required recipe, check the values are correct on the **Recipe Live** screen as shown on - see Recipe Select Screen

15 Press the **Heating** key and start the barrel heaters. A message "Up to temperature" appears when the temperature setpoint has been reached.

Note

Temperature setpoints are limited during the warm-up phase.

16 Select automatic mode, screen: **Main Menu** > **Extruder Auto** key.

17 View the current alarms screen (**Alarms** key) and clear any active alarms.

18 Press the **Start** key - the main drive starts.

When the barrel temperatures reaches setpoint for a timed period, the drives will start and run at the setpoints as set in step 1 of the selected recipe. The step status will show step 1 and the step time will count down. When the time has elapsed, step 2 setpoints will be automatically loaded, etc.

19 The start-up progresses until the running step 5 ("on production") is reached. The cutter unit automatically starts at the preset step (if set in the recipe).

20 At any point during the start-up procedure, the **Pause** key on the **Main Menu** screen can be used to hold the machine at the end of its current step. To resume the start-up procedure, press the **Pause** key again.

Note

If required, the **Manual Control** toggle key (on Main Menu screen) can be pressed, which transfers operation to manual control. All setpoints and drive status will be retained but it gives the operator the freedom to shut-down the machine manually if required (there is no going back to **Auto Mode** from this point).

21 When the correct product is be extruded, the scrap bin at the outlet of the cutter can be removed. Quickly move the cutter (if being used) and discharge equipment (such as a conveyor) into place.

15.13 Extruder Manual Shut Down

The procedure for shutting down the Extruder will largely depend on the product being prepared, and the type of liquids available. Experience will eventually determine the best and safest method of carrying out this procedure. When in doubt, users should contact Baker Perkins, however the following guidelines should prove useful.

The shut-down process should be done progressively and will normally take between 10 and 20 minutes. The object is to turn the extrudate from a high temperature "melt" into a dough-like substance and then into a slurry. To produce this change, the water should be increased gradually during the shut-down process and the powder feed can be reduced gradually.

If a washout chute is supplied, this should be fitted instead of the production die.

1 Firstly, ensure that there is sufficient product available in the feeder hopper.

2 Divert the discharge from the Extruder/Cutter into a suitable scrap receptacle.

3 From the **Main Menu** button, select the **Extruder Manual** screen - press **Cutter Stop.**

4 Reduce the powder feed to the Extruder by 25% of the normal throughput.

5 Gradually increase the process liquid by increasing the speed of the metering pumps. This can be done from the **Main Menu**.

6 Gradually reduce the powder feed to 0 and increase the liquid feed to 1.5 times that of the operating rate.

7 While the powder feed is being reduced, and when the torque indicator shows 60% or less, press the **Fast Cool** on the **Main Menu.**

8 Once the powder feed has reached 0, reduce the screw speed to 50%.

9 Continue at 50% speed until the product flow stops from the die, or water flows from the die, then stop the main drive from the **Main Menu**.

10 Switch **Fast Cool** off.

15.14 Emergency Procedure

In the event of a power cut, the following action should be taken. These are only guidelines and the action that the operator takes should also depend upon both his experience with the product and the local conditions.

If the power supply failure is for five minutes or less, and the machine was running in Automatic mode:

1 Select **Manual Mode** and set the screw speed to 5%.

2 Start the **Main Drive** and progressively increase the speed, ensuring that the torque measurement is kept below the maximum level, until 50% speed is achieved.

3 Re-introduce the Water feed at a higher rate than existed before the emergency stop. Introduce powder at a reduced rate (say 30%) than existed before the emergency.

If this procedure is not successful, carry out the following procedure:

1 Switch the heaters off - Do not switch on barrel cooling [fast cool].

2 Carefully remove the Extruder die assembly, see Removing The Cutter Die.

3 Refer to the following for removing the agitator shafts: Procedure for Opening Barrel.

WARNING SOME PRESSURE MAY STILL EXIST BEHIND THE DIE THEREFORE, WHEN REMOVING THE DIE ASSEMBLY, GRADUALLY AND CAREFULLY UNDO THE BOTTOM BOLTS FIRST SO THAT ANY LIQUID WOULD BE DIVERTED TOWARDS THE FLOOR.

CAUTION *Care must be taken not to damage the mating machined faces of these items by the use of screw drivers, chisels or wedges, as any burrs present will lead to subsequent process difficulties.*

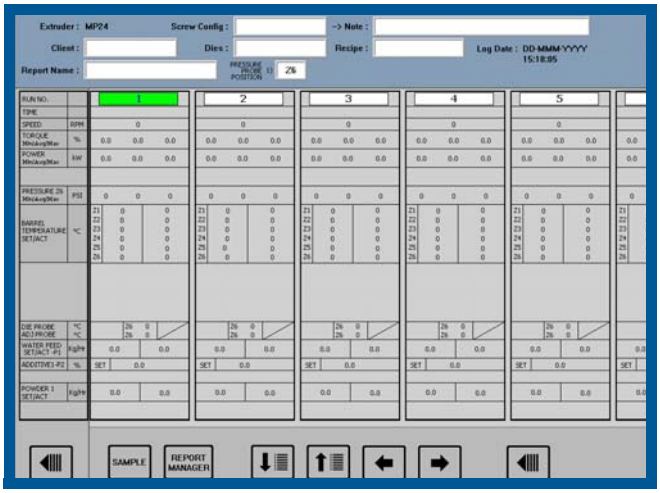
4 Disconnect and remove all other equipment from the barrel (e.g. top feeders, feeder chutes etc.).

5 Open the barrel and remove the agitator assemblies (see Procedure to Remove Agitator Segments and Shafts), ready for the next production run.

6 If agitators prove difficult to remove turn on the barrel heaters, set to 150°C, leave for 1 hour and try again.

7 Clean product from the shafts, agitators and barrel whilst still hot.

15.15 Report System Screens



Click on above to open

16 Operating the Extruder

The Extruder is controlled from an Allen Bradley 1500P touch-screen Interface Panel (HMI). The screens, associated with the Start-up and Shut-down of the Extruder, are shown in this section. All available screens are detailed in the Operator Settings & Controls section.

16.1 Pre-start Procedures

1 After the assembly of the elements onto the screw shafts, after the barrel has been torqued down and before the die is fitted, check that shafts and drive chain can rotate freely.

2 Use a spanner to rotate the shafts slowly in a clock-wise direction. Check for tight spots. If tight spots are detected, stop the shafts in that position and investigate the problem.

3 Fit the required die to the end of the barrel.

4 If a co-extrusion die is to be used (cutter not used):

- Check to cream supply is ready to be used

5 If the liquid feed system is to be used:

- Check the tanks are filled sufficiently and the feed pipes are connected to the extruder barrel ports.

6 If the cutter is to be used:

- Check the cutter is in the fully wound back position, swing the cutter assembly in place and lock the handwheel.

7 Place a suitable scrap receptacle below the product cutter at the outlet of the Extruder to catch the preliminary product during start-up.

8 Check that the powder feeder is ready to operate.

9 Check that the liquid feed pumps are ready to operate.

10 Ensure that the chilled water system is enabled.

16.2 Starting the Extruder

Before operating the Extruder, it may be necessary to login to the HMI for access to recipes etc. During Commissioning, recipes will have been saved for each product. Each recipe contains setpoint and step times optimized to give fast reliable start-ups and shut-downs with only fine tuning required to attain the required product.

1 From the Main Menu, touch the login key (on right-hand side of the screen).

Note

Login is not required if a pre-configured recipe is to be run. Login is required to edit or create a recipe.

2 See “Login Procedure” on page 75 for details. After a successful login, further functions will be available on the protected control screens.

3 On the Main Menu screen:

- Touch the Extruder key, this will display the Manual control screen
- From the Manual Control screen, press the Mode Select key to select the Auto Control screen:

4 Check the Alarm List screen to see if any faults are present - see “Alarm Features” on page 72 for details.

5 From the Auto Control screen, touch the Recipe key to display the Recipe screen.

6 Use the up / down keys to select a recipe.

7 Press the Load Recipe key.

8 Ensure that the water chiller is switched on and operating correctly.

9 Return to the Auto Control screen and touch the Heating key.

10 The extruder barrel zones will start to heat up.

11 Zero the die pressure.

12 After a pre-set time, when the barrel has reached the recipe temperatures, the Auto Start will appear on the HMI screen - press this key to start the extruder. The drives start and run at the setpoints as set in step 1 of the selected recipe. The step status will show step 1 and the step time will count down. When the time has elapsed, step 2 setpoints will be automatically entered.

13 The start-up progresses until the Running step 5 is reached.
(step 1 - 4 startup, 5 running, 6 - 9 shutdown)

14 At any point during the start-up procedure, the Auto Hold button on the Auto Control screen can be used to hold the machine at its current step. To resume the start-up procedure, touch Auto Hold again.

15 If required, the Manual button can be touched to transfer operation to manual control. All setpoints and drive status will be retained but it gives the operator the freedom to shut-down the machine manually if required (there is no going back to Auto Mode from this point).

16 To shut down the Extruder, touch the Auto Stop button. This action initiates a controlled shut-down to recipe set steps 6 through to 9.

17 Wind the cutter to the fully back position. From the Manual Control screen touch the Cutter key to stop it.

16.3 Manual Start-up Operation

To facilitate rapid start-up, the Extruder barrel must be pre-heated to the operating temperature. It should be noted that any significant amount of material in the machine from previous runs should be completely removed by washing through with clean water.

1 From the Main Menu select Extruder to access Manual Control screen.

2 Touch the Heating key to start the heaters and ensure that the cooled water supply is enabled.

3 Touch the barrel zones on the HMI screen and adjust the temperature setpoints as required.

4 Allow sufficient time for the temperatures to reach the setpoint (usually about one half hour).

5 Zero the die pressure.

6 Touch the Main Drive key to start the main drive. Set the speed to 50% from the Main Menu.

7 Start the liquid feed system.

8 Start the powder feed system.

9 As soon as possible (remember, the product is needed to lubricate the screw), adjust the feed rates from low up to normal operating levels.

10 When good product is being extruded, start the cutter and adjust to cut the product.

The onset of the processing reactions within the Extruder is signalled by an increase in power required to turn the agitators. When the percentage torque reading indicates this increase in torque, the speed may need to be increased to prevent overloading the unit. When the barrel and die have reached stable operating temperatures, adjust the water feed rate, powder feed rate and speed to obtain the desired product at a moderate torque level (90% or less).

Care must be taken to prevent an over-torque shutdown by over-feeding with dry feed. Once the speed is established, and additional feed streams are to be used, they should be started one at a time, watching the torque level reading to ensure the load does not exceed 95%-100%.

If, at any point during the Extruder start-up procedure a fault occurs, an alarm will sound and the Extruder may shut down automatically. Refer to the section on “Extruder Faults” for details of rectification procedures.

16.4 Extruder Faults

Under certain conditions during start-up and normal running, faults may occur that need to be rectified. When one of these faults occurs, the audible alarm will sound. A list of the faults and remedies is shown below. In some cases, if the fault is not corrected, the Extruder will automatically shut-down. The alarm can be silenced by touching the "Ack" button on the Alarm screen.

see next page....

Extruder Faults

Fault	Indicated By	Cause	Remedies
Die pressure high	Pressure Indicator shows high level, over 2000 p.s.i. and alarm message	Blocked die	Reduce powder feed
		Overfeeding	Reduce throughput
		Liquid Starvation	Increase liquid feed
Torque Level High	Torque Indicator shows high level over 105% and alarm message	Overfeeding Blocked die Liquid starvation	Reduce feed
			Reduce powder feed. Shut down and clean die
			Increase liquid feed
Barrel temp. out of tolerance	Temp. Indicator shows a fault Alarm message	Too large a setpoint between zones	Reset setpoints
		Cooling water failure	Check and correct
		Heater failure	Check and correct
		Product generating excess heat	Reset setpoints and/or change screw profile

Extruder Automatic Shutdown

Under the above, and certain other conditions, during the start-up procedure, and normal running, the Extruder will automatically shutdown. The two types of overload are, electrical motor load shutdown (115% motor load) or the mechanical torque limiting coupling disengage (120% torque

load): in these cases the Extruder main drive and all feeds are stopped.

Fault	Indicated By	Cause	Remedies
Excessive die pressure	Die pressure will rise, the alarm will sound	Blocked die or Over feeding or Liquid Starvation	Follow the Emergency Shutdown procedure and investigate reason
Main Drive Overload	Torque High Level alarm sounds	Over feeding or Blocked die or Foreign body in barrel	
Power Supply fault	Other units fail to operate	Power cut	Follow the Emergency Shutdown procedure, then check and correct
Main Drive Controller fault	Message	Overcurrent	
Motor overheating	Message	High ambient temperature	Follow the Emergency Shutdown procedure. Allow time for the motor to cool down and then rectify fault.
Emergency Stop button pressed	Stoplock part of push-button engaged	Deliberately or accidentally pushed	Follow the Emergency Shutdown procedure
Any machine mounted interlock is broken		Any safety guard is removed	

16.5 Manual Shut Down

The procedure for shutting down the Extruder will largely depend on the product being prepared, and if liquids can be feed into the barrel. Experience will eventually determine the best and safest method of carrying out this procedure. When in doubt, users should contact Baker Perkins, however the following guidelines should prove useful.

The shut-down process should be done progressively and will normally take between 10 and 20 minutes. The object is to turn the extrudate from a high temperature "product" into a dough-like substance and then into a slurry. To produce this change, the water should be increased gradually during the shut-down process and the powder feed can be reduced gradually. If oil and/or lecithin are available, gradually introduce these to give a greasy feel to the extrudate.

16.6 Cleaning After Shutdown

DURING THIS CLEANING PROCEDURE, IT IS ESSENTIAL THAT OPERATORS WEAR PROTECTIVE CLOTHING INCLUDING HEAT RESISTANT GLOVES, STEEL TOE-CAPPED SAFETY SHOES, APRON AND FACE VISOR.

Turn off the power supply to the extruder, see Electrical Lock Out and Tag Out of Isolator

1 Release the cutter assembly and swing to the open position.

2 Remove the Extruder die assembly. Care must be taken not to damage the mating machined faces of these items by the use of screw drivers, chisels or wedges, as any burrs present will lead to subsequent process difficulties.

WARNING SOME PRESSURE MAY STILL EXIST BEHIND THE DIE THEREFORE, WHEN REMOVING THE DIE ASSEMBLY, GRADUALLY AND CAREFULLY UNDO THE BOTTOM BOLTS FIRST SO THAT ANY LIQUID WOULD BE DIVERTED TOWARDS THE FLOOR.

Remove the screw shafts as described previously in this section and thoroughly clean all components.

17 Process Instructions

Note

These operating instructions require that your machine is properly installed, powered, wired and piped. Refer to installation recommendations.

Substances entering the extruder may present hazards by virtue of:

- The raw material properties
- By-products formed, and released by the process
- The product itself
- Additionally there may be a possibility of reactions occurring between the product and residual matter from processing previous formulations.

An assessment of the potential risks involved and the safety precautions necessary with all proposed processes, must be exercised by the user, in accordance with safety legislation relating to hazardous materials.

Before starting your new Extruder there are several basic concepts and instructions that must be followed. The first section of these process instructions covers the basic theory of operation and set-up. The second section covers specific operating procedures. The third and final section covers process optimization, which might be considered trouble-shooting from a process, rather than a mechanical or electrical standpoint.

17.1 Theory of Operation

The technology to prepare expanded edible products for consumption as snacks or breakfast cereals, and other products has long been established. However, high protein mixes have a tendency to form tough, textured extruded products rather than light, crisp textures. High temperature extruders are capable of producing expanded food products, such as snacks and cereals. The expansion occurs when the moist dough exits from the high pressure environment inside the extruder barrel to the low pressure environment outside. Superheated water at temperatures exceeding the boiling point instantly vaporize and expand, forming bubbles within the dough. The bubbles grow until the temperature of the dough pellet drops to the boiling point of water. The relationship between pressure and boiling point is well understood and data tables are published.

In the manufacture of predominantly starch based ready to eat breakfast cereals and snack foods, increased expansion at the die is typically achieved by increasing the temperature of the dough. Means for the temperature increase are well known, and are principally viscous dissipation of mechanical energy, thermal transfer "from the walls of an extruder and introduction of steam either into a pre-conditioner or directly into the barrel of an extruder. High protein dough however, is susceptible to discolouration and increase in viscosity at elevated temperatures.

A twin screw extruder is able to accomplish the cooking part of the process as the material is being advanced along the extruder barrel in a manner which is quicker than that of a single screw cooking extruder. It is also better able to advance more viscous extrudates. A high protein food product is more viscous than a lower protein product.

Feeding the Extruder

In most cases the conveying capacity of the feeding section of the extruder twin screw exceeds the mixing/cooking capacity, and hence a metering device must be used to feed the twin-screw compounder. This metering device should be capable of a continuously adjustable range of feedrate that is uniform for a given setting. (Uniform feed means that rate checks on several consecutive 10 second samples are within 5% of the average). The uniformity of feedrate is important because of the relatively short residence time of the material in the mixing zone(s), and an unsteady feedrate is likely to cause torque surges. If a granule feed is used, individual pellets should be <3mm to allow intake into the screw channels. Typical residence time will be 20-45 seconds for a 15D barrel, and 40-90 seconds for a 25D barrel and so on, i.e. longer barrel machines will have a proportionally longer residence time. Typical solid feeding devices include:

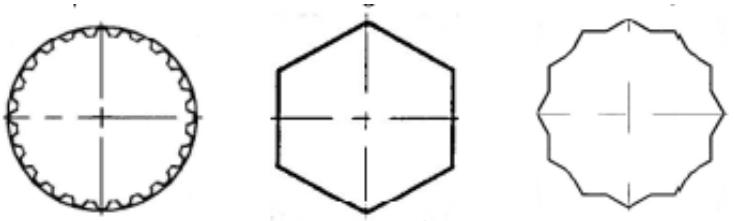
- Single screw feeders (volumetric or gravimetric)
- Vibratory feeder

Discharge from the Extruder

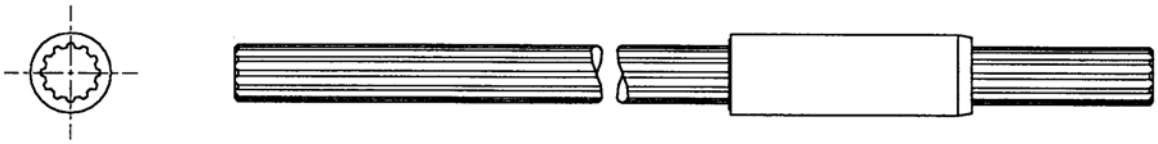
The extruder is designed for use with an optional die assembly to channel the stream to a centre discharge point ready for take off or cutting. A pressure transducer monitors the discharge pressure at the die. A "burst disc" is fitted to safe guard the barrel from excess pressure. To prevent access to the moving shafts, the transition piece must be bolted to the end of the barrel.

Agitator Assembly

Note For this contract, the extruder is supplied with splined agitator components. Baker Perkins manufacture three different types:



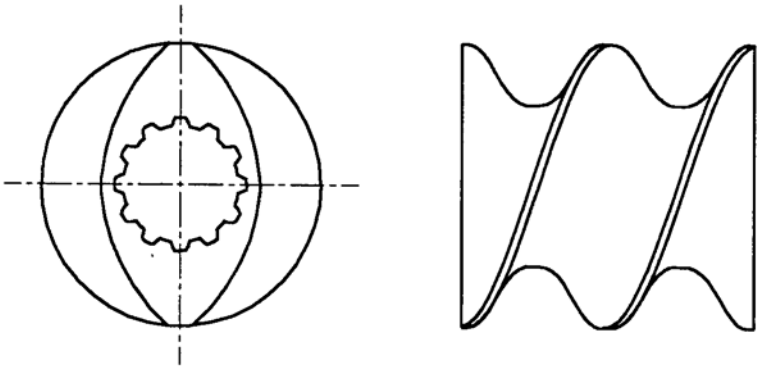
Shafts



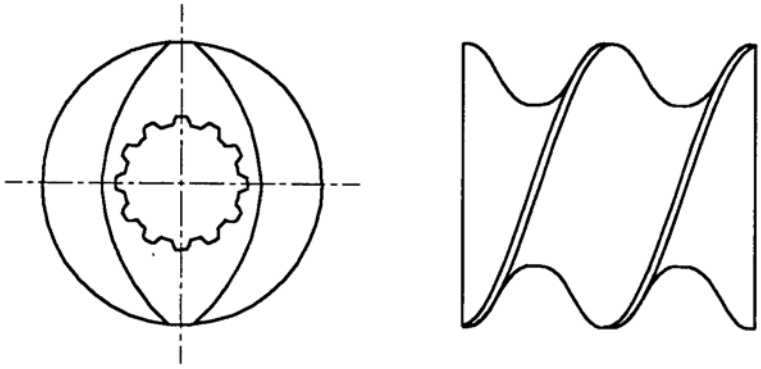
The extruder agitator shafts serve both as the core on which the slip-on agitator parts are assembled, and as a means to transmit the mechanical energy from the drive to the agitator components. At the agitator components this mechanical energy is converted to work (heat and mixing) on the feed materials.

Feedscrews

Feedscrew L=1.5D

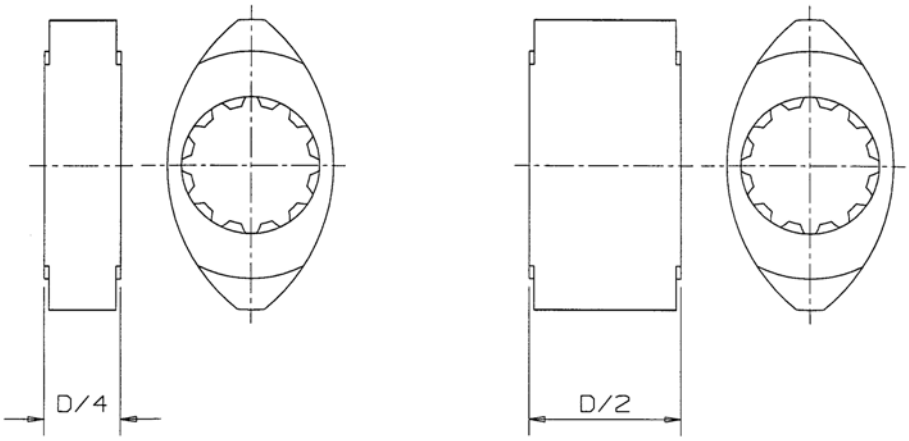


Feedscrew L=D



The function of the feedscrew components is to convey the materials downstream within the extruder. The feedscrew conveying action will push material through paddle sections, which themselves have a low forwarding capability. Standard feedscrews have a twin lead with a pitch of 1 diameter.

Paddles

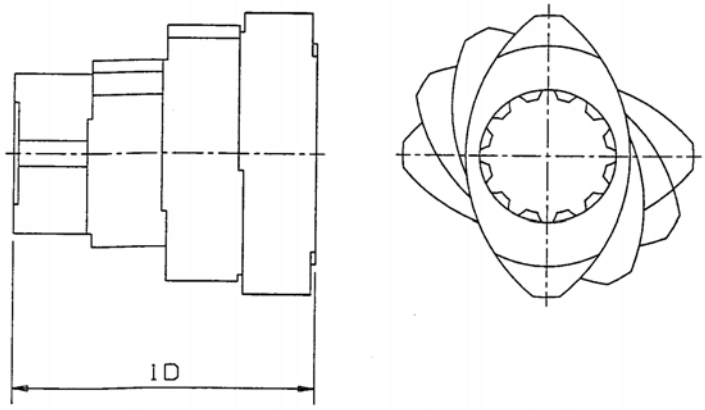


Paddles are the primary working component of an agitator assembly. Paddles are available in the following axial lengths with respect to the extruder diameter (D).

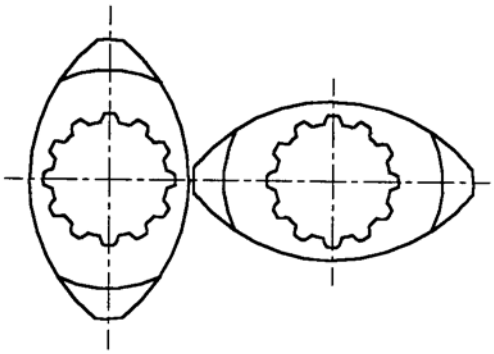
D / 4 - general purpose use in a block of 4x30° forward paddles. Used at the beginning of the first stage for strength. Also available as individual units.

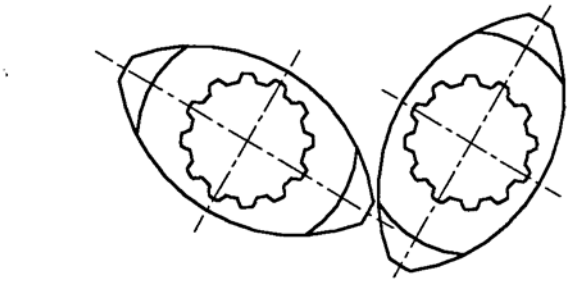
D / 2 - used for dispersive mixing of solids. Available as individual units.

Block Paddle (4 x 30°FP D / 4)



Paddle Orientation



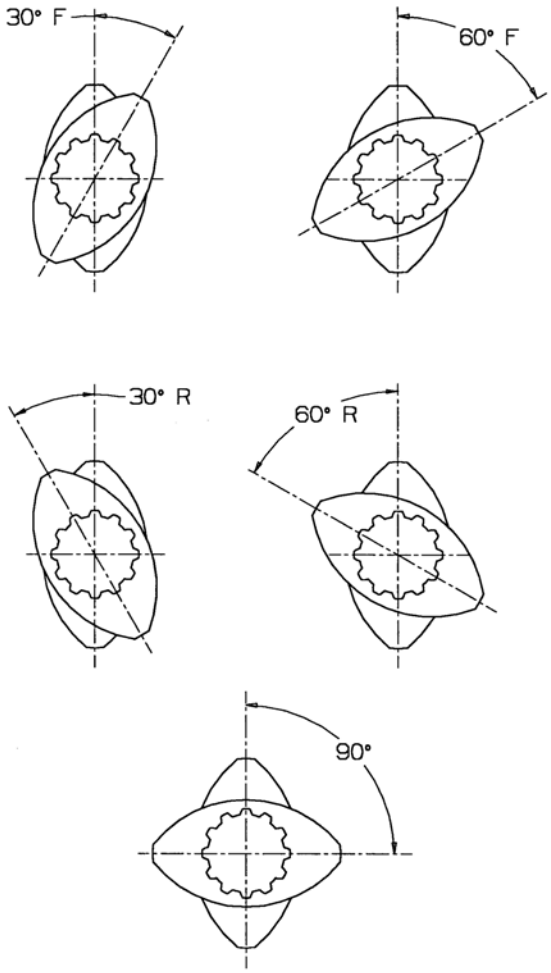


CAUTION *Paddle "pairs" must always be oriented 90° from each other on adjacent shafts.*

Paddle Offset Angles

F=Forwarding

R=Reverse



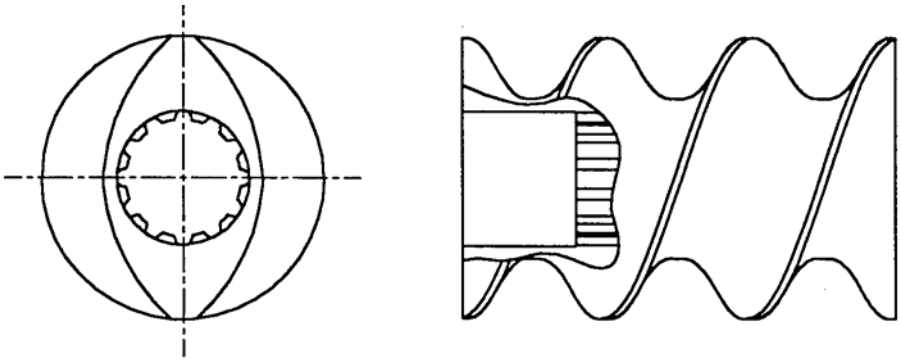
When observing consecutive paddles on one agitator shaft, several relative orientations are possible as illustrated above.

Note

Above illustration is viewed from the discharge end.

Discharge Screws

Twin Lead Discharge Screw



These screws convey the final product past the discharge adaptor.

Machine Instrumentation

Extruder Speed

An analogue or a digital meter is provided, showing the speed of the extruder shafts.

Extruder Torque

The armature current of the DC motor is proportional to the load or torque necessary to turn the agitator shafts at the operating speed. This is displayed as a percentage of the maximum operating torque of the MPF24.

Barrel Temperature

Each heated zone has a temperature controller which reads the actual temperature of the barrel via a thermocouple. The temperature controller switches the heater (via a solid state relay) and the flow of cooling water (via a solenoid valve if fitted.) Once the setpoint temperature is reached this temperature will be maintained.

17.2 Operating Procedures

Note

Cleaning - Before any agitator assembly is attempted, care must be taken to ensure the shafts and slip-on components are clean and free of nicks or burrs. Of special concern are the bores and mating faces of the components. Residual material in the agitator bores may cause difficulties in assembly as well as making disassembly extremely difficult. Contamination or burrs on the mating faces can also cause bending of the agitator when the assemblies are tightened, and in the worst case, interference between the agitator components on opposite shafts (Nicks and burrs can be removed with a stone or fine file).

Designing an Agitator Configuration

See "Agitator Assembly" on page 101, for component illustrations.

Typical information required initially is:

- What are the ingredients?
- Are the fillers/pigments easily dispersed?
- Do any of the ingredients have critical temperatures?

Once the parameters discussed above are known and the basic one or two-stage system decided upon, the agitator design mechanics begin. The mixing section(s) design must be undertaken first.

1 A few basic statements will aid in understanding mixing section design.

- Paddles are better mixing components than feedscrew sections (Experimentally determined by dispersion of colour addatives)
- Paddles work hardest on the product when they run full of material.

2 Next, determine the number of paddles to be used in the mixing section.

The "rules of thumb" concerning paddle orientation are:

Conveying Ability

- 30° paddles have a significant conveying tendency and therefore often operate with a low degree of fill
- 60° paddles have some conveying tendency
- 90° paddles have no conveying tendency and therefore run full.

Remember conveying ability is directional. Both forwarding (downstream conveying) and reversing orientations (opposing downstream conveying tendency) are attainable.

Within a mixing section, forwarding tendency must not increase downstream. Poor stability of power input, thus poor product uniformity can be the result.

In extreme situations very high localised forces can be applied to the agitator components.

For example:

4 x 30°FP, 3 x 30°FP, 4 x 60°FP, 4 x 90°P, 4 x 60°RP is allowed

but

4 x 30°FP, 3 x 30°FP, 4x 60°FP, 4 x 90°P. **3 x 30°FP**, 4 x 60°RP **is not allowed.**

In case of doubt, please refer to Baker Perkins via the Customer Services Department for confirmation.

Generally, reversing paddles must be at least balanced by an equivalent forwarding section upstream within the same mixing section.

When in doubt, a good starting configuration is 5, 30° forwarding paddles followed by 4, 60° forwarding paddles, followed by 6, 90° alternating paddles, and finally 3, 60° reversing paddles.

3 An appropriate combination of feedscrew components should be selected to make up the required total length of the agitator design.

4 Longer axial length paddles (e.g. D/2 paddles) give increased dispersive mixing (micro scale agglomerate breakdown) than shorter axial length paddles (e.g. D/8 paddles) and conversely, the shorter axial length paddles give increased distributive mixing (homogenisation.)

Assembly of the Agitator

Unlike some of the larger machines, in the MPF24 the assembly of the agitator components onto the shafts is more easily achieved on the bench, rather than with the shafts in situ. It is thus essential that the desired agitator configuration is clearly written down or sketched.

1 Be sure the agitator shaft is clean.

2 Lubricate the shaft with a suitable high temperature anti-seize compound.

3 Be sure the slip-on components are clean and free of burrs, especially the shaft, bore, and mating surfaces.

4 The shafts are provided with a reference notch at the discharge end to assist assembly of the individual shafts.

5 Twin lobed elements (standard twin lead feedscrews and paddles) are located at 90° to each other on adjacent shafts when installed in the extruder; whereas pairs of single lead elements must be placed on adjacent shafts so that they are in line with each-other when the shafts are installed.

6 The first paddle in each mixing stage on each shaft is installed so that its lobes are in-line with the lobe of the preceding feedscrew. Each paddle is installed at the desired angle relative to the one immediately upstream.

7 When assembling the paddles in a mixing stage, remember that the shafts have 12 splines, and hence turning a paddle by one spline represents an orientation of 30°, turning by two splines 60°, and so on.

8 After insertion of the pair of assembled agitator shafts, rotate the extruder by hand to assure clearance exists between all parts, that paddle pairs are offset 90° compared to each other, and that single lead feedscrews (if fitted) are correctly oriented. Close the barrel and again rotate the drive by hand. If binding is felt, the cause must be determined and corrected.

Typical Agitator Configuration MPF24 (25:1)

Closing the Barrel

• See “Tightening Torques” on page 137.

Delivery End Centre Feed End.

w	s	o	k	g	e	a	c	i	m	q	u	y
x	t	p	l	h	d	b	f	j	n	r	v	z

Operators Side

The barrel bolts should be replaced after every 5000 hours running. Only barrel bolts supplied by Baker Perkins should be used for this purpose.

Ensure that all the joint faces and screw threads are absolutely clean and that all thermocouples, thermocouple plugs and injectors in the top half of the barrel are slackened off by at least one turn (this can be detected when they can be turned by hand). Close the barrel until the two halves are 2-3mm apart. At this point, lubricate all the screw threads on the barrel bolts and place two of them in the barrel assembly - one positioned at the die end and one at the feed end of the barrel in holes on the operator side (at approximately positions "p" and "r" on Figure 1). Use these two screws to lower the top half of the barrel the remaining 2-3mm but **DO NOT TIGHTEN.**

Screw in all bolts in the top clamp bars into the seal housing (bulkhead) and finger tighten them. Tighten the clamp bar bolts to approximately half their final torque. Ensure the barrel liner faces at the die end are flush. If supplied, all side feeds and side feeder plugs should be fitted at this stage.

Using the Torque Wrench, finish-tighten the clamp bar bolts.

Insert all the remaining bolts along the length of the barrel and finger tighten them. Then using the torque wrench, finish-tighten the barrel bolts working from the centre outwards and each side alternatively.

The previous page shows a suitable sequence for finish-tightening the barrel bolts on a long Extruder Barrel, starting at "a" and moving from the centre of the barrel outwards, and at the same time moving from one side to the other, finally finishing at "z". The same principals still apply when closing shorter barrels.

After the barrel bolts are tightened, the transition plate and die (if supplied) can be assembled. An even seal on the die plate is very important to prevent leaks. Since the barrel liner protrudes beyond the barrel and can act as a pivot point, it is very important that die bolts are alternately tightened in gradual increments to provide an even seal.

17.3 Example Start-Up Procedure

The following sequence of operation must be observed whenever using your Extruder assembly.

1 If the MPF24 Extruder is clean, be sure it rotates freely without noise.

2 Turn on heater controllers - set to appropriate operating temperatures.

3 Allow sufficient time for the temperature to reach equilibrium within each control zone. (Usually about 5-10 minutes after the controllers reach set point).

4 Always start the most downstream piece of equipment first. The MPF24 Extruder must be running before feeder is started.

Note

It is desirable to have the MPF24 Extruder interlocked to assure all upstream equipment is turned off in case of failure.

5 Start the extruder screws at the minimum speed.

6 As soon as possible (remember that product is needed to lubricate the journal regions), start a product and liquid feed stream at low rate (about 0.5 kilograms/hour, depending on the type of formulation being processed).

TIP

The onset of mixing and cooking within the extruder is signalled by a sharp increase in power required to turn the agitators. When the % torque meter indicates that a stable load has been achieved, the extruder screw speed can be increased to operating speed. This should be followed by increasing the feedrate.

7 Care must be taken to prevent an over-torque shutdown by overfeeding the MPF24 Extruder. Once the process is established within the extruder, the feedrate should be increased gradually, watching the load meter to assure the load does not exceed 95-100%

8 Start the cutter and wind in to cut as soon as the product is stable.

9 Equilibrium usually requires about 15 minutes. Fine adjustments can be made to the feedrate, extruder speed and barrel temperatures.

17.4 Shutdown Procedure - General

1 As with start-up, shutdown procedures must be followed in sequence. The feeder is shutdown first.

2 If purging is required, carefully meter sufficient purge product to purge the previous ingredients, additives and fillers etc. from the MPF24 Extruder.

3 When the extruder drive % load meter readings drop to below 25%, the extruder drive can be shut off.

4 Switch off the barrel heating and cutter, wind the cutter fully back.

17.5 Dead Stop Shutdown

The dead stop shutdown is used to determine what occurs within the extruder. After achieving equilibrium operating conditions, the feed streams and extruder are stopped instantly and simultaneously. The MPF24 Extruder barrel is opened as rapidly as possible after **lock-out of the control panel**. Once the agitators are exposed, the following observations are made:

- Where does mixing begin?
- Where is cooking achieved?
- Temperatures of the product can be taken with a needle probe, if desired.

The information obtained from a dead stop shutdown will aid in optimization of the agitator or diagnosing dispersion problems. This will be covered in a later section - See “Interpretation of the "Dead Stop"” on page 111.

17.6 Process Optimization

Process Trouble Shooting

Once the initial agitator configuration has been run (see “Designing an Agitator Configuration” on page 106), observation of results may now lead to design modifications of the agitator configuration. The following table lists various problems.

	Symptoms	Possible Actions
1	Product Temp too Hot.	Increase feedrate - up to 95% compounder torque. Reduce extruder speed and feedrate - run at 95% torque. Reduce barrel temperatures. If product spray up appears consistently OK, then question “too hot” assumption. Decrease intensity of screw configuration.
2	Product Temp too Cold or Dispersion not good.	Decrease feedrate - keeping speed constant. Increase screw speed. Increase barrel temperatures if excessively low. Increase screw intensity / residence time / length. Increase premixing time / intensity to break up resin chips.
3	Surface Defects - “Orange peel”.	Surface tension of mixture low - check formulation. Viscosity of mixture too high - check formulation - possible pre-cure of reactants - (treat as 1) Film spray deposits too thin or uneven - adjust spraying technique.
4	Surface Defects - Craters.	Insufficient wetting of substrate. - surface tension too high - check formulation. - contamination of substrate - clean thoroughly. - particle size of powder inconsistent. If coffee ground, try mill grinding. Mix contains un-dispersed ingredients (e.g resin). (treat as Section 2).
5	Flood Feeding.	Increase compounder speed or Decrease feedrate. - Until stable intake condition is achieved. Increase average particle size of premix. - decrease proportion of reprocessed fines - decrease premixing time / intensity to reduce unnecessary particle attrition. Change orientation of paddles to give more forwarding. Reduce number of paddles.
6	Torque Surges.	Premix inconsistent - content or particle size. - optimise premixing time. - eliminate segregation (check feed hopper agitation.) Feedrate inconsistent. - check consistency of feeder drive (feeder speed vs potentiometer setting) -check (visually) loading of metering screw (if severe pulsing, contact supplier). Variable position of melt formation - adjust barrel zone temperatures, so that melting is initiated on first 6 paddles. - adjust screw configuration if not suited to position of barrel zoning.

Interpretation of the "Dead Stop"

Observation	Possible Actions
Melting on Feedscrew	- replace feedscrew with 30° forwarding paddles to meet existing paddles. - use greater forwarding paddle orientation. - decrease barrel temperature setpoints before, and at start of mixing stage.
Incomplete Melting	- use less forwarding paddle orientation. - increase the number of paddles in the mixing stage.

17.7 Glossary of Terms

Compound - The operation of mixing/cooking, dispersing and distributing all ingredients into uniform finished product.

Die - Any restriction plate to compress and shape the discharge from the extruder. Examples can include rope dies, slit dies, strand dies, sheet dies.

Dispersion - A measure of the breaking of agglomerates of a pigment or filler into individual particles.

Distribution - A measure of uniformity of the mixing of individual pigment or filler particles within the final product.

Downstream - Refers to units or the general direction along the normal flow of ingredients.

Feeder - Any device used to consistently meter a controlled rate of an ingredient into the extruder.

Flooded - This refers to the feed ports of the MPF24 Extruder. With most materials the MPF24 Extruder will convey the metered feed materials away from the feed port faster than they are fed. However, some low bulk density, fluffy materials will built-up in the feed throat. This is called flooding.

Forwarding - This term applies to the orientation of MPF24 Extruder paddles assembled on the agitator shafts. When the offset from the previous upstream paddle, viewed from the discharge end, is less than 90° clockwise there is a tendency for the paddle to convey material toward the discharge, thus, the orientation is designated forwarding.

Interlock - This expression describes the condition where a particular function of the system is electrically connected to a second function so that in order for the first to operate, the second must already be operating.

Lead - The lead is the flight of a screw. MPF24 Extruder feedscrews are double lead (two flights start 180 degrees from each other) with the lead length (pitch) equal to one bore diameter.

Lobe - A lobe is the elongated blunt point of the MPF24 ExtruderMPF24 Extruder Agitator part when viewed from an end surface. Most parts used to form the MPF24 Extruder agitator are bi-lobed. The paddle exhibits this characteristic most clearly.

Mass - The material combination obtained after ingredients are at least partially mixed and blended.

Melt - The fluid or semi-fluid state of a product reached as temperature is increased.

Mix - The operation of intimately combining either various ingredients or dissimilar portions of the same ingredient into a uniform mixture.

Reversing - This term is applied to the orientation of a paddle which is counterclockwise when viewed from the discharge end. There is a tendency for the paddle to oppose the conveying of material, and hence the orientation is designated reversing.

Starved - Describes the condition where the conveying section (usually a screw) is not full of materials.

Torque - Is a measure of the force required, or available, to turn the MPF24 Extruder agitator shafts. The output power of the DC drive motor is proportional to the armature currents. AMP meters with a scale of 0-150% are installed to indicate the relative torque from the drive motor.

Upstream - Refers to plant items or positions in the general direction against the normal flow of ingredients.

18 General Maintenance

WARNING BEFORE ATTEMPTING MAINTENANCE OF ANY DESCRIPTION ON THE EQUIPMENT ENSURE THAT YOU HAVE READ AND UNDERSTOOD THE SAFETY SECTION OF THIS MANUAL.

WARNING BEFORE ATTEMPTING MAINTENANCE OF ANY DESCRIPTION ON THE EQUIPMENT ENSURE THAT IT IS ISOLATED FROM ALL POWER SOURCES:-

- ELECTRICAL SUPPLY.
- PNEUMATIC SUPPLY.
- HYDRAULIC SUPPLY.

ENSURE THAT THE LOCK OFF PROCEDURES HAVE BEEN APPLIED.
ENSURE THAT ANY EQUIPMENT WHICH OPERATES AT ELEVATED TEMPERATURES HAS COOLED TO A SAFE WORKING TEMPERATURE BEFORE STARTING WORK.
FAILURE TO CARRY OUT THESE INSTRUCTIONS COULD RESULT IN SERIOUS INJURY.

WARNING IT MAY BE POSSIBLE FOR THE EQUIPMENT TO APPEAR “SWITCHED OFF” BECAUSE IT IS NOT MOVING.
TURNING THE SPEED CONTROL TO ZERO CAN CREATE THIS EFFECT ON EQUIPMENT THAT IS ACTUALLY STARTED.
ALWAYS FOLLOW THE LOCK OFF PROCEDURES.

18.1 General

After the machinery has been running for one month, check that all the nuts, screws, setscrews, taper pins etc are tight. These should then be checked over periodically. Include all electrical terminals in these checks.

Refer to the Other Manufacturers Leaflet (OMLs) section of the manual for information on equipment not manufactured by Baker Perkins.

18.2 Safety Devices

All safety devices must be checked for correct operation at weekly intervals.

WARNING DO NOT RESTART THE MACHINE UNTIL ALL GUARDS HAVE BEEN SECURELY REFITTED AND SAFETY SYSTEMS CHECKED FOR CORRECT OPERATION.

18.3 Running After Adjustment or Repair

Before attempting to run the machine under power, make certain that any components which have been the subject of adjustment or replacement have been correctly fitted. Check closely to see that all screws, nuts, pins, bolts etc. have been replaced and that they are all secure.

After any parts have been reset or replaced, the machine should be turned over by hand, if possible, before supplying power. This precaution will prevent the possibility of damage being caused by the incorrect fitting or setting of parts.

If after maintenance it is necessary to run any part of the equipment under power with any guard removed or safety device by-passed for access for tuning, then every precaution must be taken by the engineer to ensure that safe working practice is employed. In particular it is essential that any unauthorised personnel cannot approach the area exposed. If necessary, temporary guarding or safety barriers must be erected.

18.4 Routine Maintenance

Regular maintenance is essential to prevent expensive stoppages of production. It is impractical to give a definitive time schedule between maintenance inspections as local conditions will vary. However, Baker Perkins recommend that regular preventative maintenance be carried out and any items requiring attention dealt with as soon as possible to prevent any further damage.

Not carrying out preventative maintenance increases the possibility that the equipment will fail during production causing expensive downtimes.

This section lists items that should be included in the users' preventative maintenance schedule.

For more information on operation and maintenance of equipment not manufactured by Baker Perkins, refer to the relevant manufacturers leaflet in the Other Makers Leaflets section.

Mechanical Components

Support Struts

The function and integrity of support struts fitted to any opening guards or covers should be checked weekly. Replace as required - do not try to repair or modify.

Welded Components

Where components are subject to stress and load, it is important that they are checked regularly (weekly) for integrity and general condition of the welds. Failure to carry out these inspections could result in serious damage to the machine if a weld fails.

Driving Chains and Belts

Should be checked regularly (weekly) for general condition and tension, adjustment being made if necessary.

Motors and Drives

Regular attention (monthly) should be paid to the mountings to ensure they have not worked loose, and that the drive alignment is correct. Adjust and tighten if necessary.

Steam Lines and Fittings

Particular care must be taken to ensure any steam leaks are located and repaired as soon as possible.
Steam is dangerous and presents the risk of injury to personnel working in the area.

Air Lines and Fittings

Regular inspection (monthly) of the pneumatic system should be made and any leakages corrected. Any air lubricators should be topped up with lubricant and filters should be checked and cleaned - details of these and other associated items will be found in the Other Makers Leaflet section.

Hydraulic Systems

Regular inspection (monthly) of the hydraulic system should be made and any leakages corrected. When replacing the hydraulic fluid checks must be made to insure that the fluid is of the correct specification and quality.

Seals and Gaskets

Replace any seals or gaskets that show signs of deterioration or damage. When assembling ensure that any nuts etc are tightened evenly so that the seal and housing are drawn square to the shaft.

Bearings

When replacing a bearing always ensure that it is correctly lubricated. Note that many bearings are sealed units requiring no further lubrication.

Conveyor Belts

Should be checked regularly (weekly) for general condition. The belt tension and belt tracking should also be checked at the same time to ensure maximum belt life. Where automatic belt tensioning and tracking systems are fitted they should be checked for correct operation.

18.5 Electrical Maintenance

General

Components with moving parts should be inspected at intervals related to their frequency of operation.

Pitting of electrical contacts after a short period of service is normal bedding-in and is not detrimental to their operation. Modern contacts have a special finish and must not be ‘dressed’.

Silvered contacts will oxidize and become black and should not be polished since this would remove some of the coating.

Cleaning

Cleanliness is normally covered by the action of cleaning down the machine in general. However dust can accumulate inside panels and other enclosures.

Every six months these should be cleaned using a vacuum system. If this is not available use a hand blower or a compressed air line. Avoid excessive use of compressed air because entrained moisture could be as harmful as the removed dust. Also be aware that the air will blow the dust somewhere else!

In dust (flour etc) areas door seals should be checked to prevent the dust ingress to control gear.

Inspection

The normal mechanical life of relays and contactors is approximately five million operations. Baker Perkins therefore recommends that those components which are subjected to frequent switching be checked and, if necessary, replaced after approximately five million operations.

Control equipment situated in dusty atmospheres should be inspected more frequently, with particular attention being paid to the condition of the door seals to prevent the ingress of dust to the equipment.

Relays not subjected to frequent operation e.g. those in alarm and safety circuits should be inspected and tested regularly (weekly). A formal test procedure should be set up in the bakery to ensure regular testing of all safety systems.

Inspection requirements for relays and contactors are related to the frequency of operation is as follows:

Type	Frequency	Action
Low Duty	Operated less than once an hour	Inspect every 6 months
Normal Duty	Operated more than once an hour but less than once per minute	Inspect every 3 months
High Duty	Operated more than once a minute	Inspect every month
Safety Duty	n/a	Inspect and test weekly

In components which have sealed or enclosed contacts inspection is limited to the mechanical action and visible moving parts.

Other Electrical Equipment

Connections and Leads

Every six months check all terminals for tightness, security and that they are safe. Check that all insulating and safety shrouds are securely in place and in good condition.

Check that flexible cables have freedom of movement, particularly on devices which move frequently, eg tier selector booms.

Check that the insulation of cables has not been cracked or abraised by moving parts, either mechanical or by opening doors or covers.

Fuses

No inspection required.

If one power fuse ruptures on a three phase supply then the other two should be renewed also. Always replace fuses on a three phase system as a set of three.

Earth Leakage Protection Devices

Where these are installed a regular (monthly) operation check should be carried out.

Clutches and Brakes

Refer to the manufacturers instructions for inspection requirements with due regard to the frequency of operation.

Transistorised / Solid State Devices

The life of transistorised and solid state devices is indefinite. In the event of failure of a transistor device, circuit or component, it is recommended that repair should not be attempted. Renew the complete unit or plug-in board. Sophisticated tooling is generally necessary to implement repairs on this type of equipment and tampering with it may invalidate any warranty from the manufacturer.

Limit Switches

The actuator should be regularly inspected (monthly) for freedom from wear or damage. The operation and alignment should be checked and adjusted if needed. Inspect the rod or roller and any rubber seal round the plunger actuator. Renew the switch after approximately one million operations.

Reed Switches

Reed switches are sealed, and no regular inspection is required except to check that the mounting is secure.

Damage to the contacts can be caused if the switch is operated without the spark suppression components which are included in the control circuit.

Photo Electric Detectors

Lamp and cell units should be firmly mounted to maintain correct alignment of the beam.

Dirty lenses can reduce the sensitivity of operation. Regularly clean the lenses with a clean cloth. The required interval will depend upon operational conditions.

Proximity Detectors (Inductive or Capacitive)

These are solid state devices and require no periodic maintenance, except to check that the mounting is secure with the correct sensing gap and to wipe them clean. The frequency of cleaning will depend upon operational conditions.

Plug-In Timers

The plug-in timer is transistorised and contains a relay similar to the normal plug-in relay with similar life and maintenance requirements.

Laser Sensors

Where these are installed a regular (monthly) operation check should be carried out. The laser lens MUST NOT be wiped with an abrasive material.

18.6 Maintenance Log or Record

It is essential for the user to record all maintenance activities on the equipment. Such a log will assist in identifying any persistent problems, keep track of consumable and spares items used and also act as a means of communication from one group of maintenance engineers to another.

A sample chart for this log is included for your convenience.

MAINTENANCE RECORD.

Machine
No:.....

Particulars of Work Done	Date	Signature

19 Maintenance & Lubrication

19.1 Maintenance Safety

WARNING BEFORE PROCEEDING WITH ANY FORM OF MAINTENANCE OPERATIONS, FULLY READ THE RISK ASSESSMENT AND THE SAFETY SECTION OF THIS MANUAL. MAINTENANCE PERSONNEL MUST BE FULLY AWARE OF ALL THE VARIOUS FUNCTIONS OF THIS MACHINE AND ITS SAFETY FEATURES.

WARNING BEFORE ATTEMPTING MAINTENANCE OF ANY DESCRIPTION ON OR NEAR TO THE MOVING PARTS OF THE MACHINE, ENSURE THAT THE MAIN DRIVE UNIT IS ISOLATED FROM THE ELECTRICAL SUPPLY. THIS IS A SAFETY PRECAUTION TO GUARD AGAINST THE POSSIBILITY OF INJURY DUE TO ACCIDENTAL START-UP WHILST WORKING ON DANGEROUS PARTS OF THE MACHINE, E.G. BEARINGS, GLANDS, AGITATORS, ETC.

WARNING IT IS POSSIBLE FOR THE MACHINE TO APPEAR "SWITCHED OFF" BY TURNING THE SPEED CONTROL TO ZERO. THEREFORE, CHECK THAT THE MACHINE IS ACTUALLY ISOLATED FROM THE ELECTRICAL SUPPLY.

Items requiring maintenance but not found in this section will be covered where applicable, by a maker's instruction - See “Index of Other Makers Leaflets” on page 173.

Safety Devices

All safety devices must be checked for correct operation at weekly intervals.

WARNING DO NOT RE-START THE MACHINE UNTIL ALL GUARDS HAVE BEEN SECURELY RE-FITTED.

Running After Adjustment or Repair

Before attempting to run the machine under power, make certain that any components which have been subject to adjustment or replacement have been correctly fitted. Check closely to see that all screws, nuts, pins, bolts etc. have ALL been replaced and that they are all secure.

After any parts have been re-set or replaced the machine should be turned over by hand, (if possible,) before supplying power. This precaution will prevent serious consequences following the incorrect fitting of parts.

19.2 Routine Maintenance

WARNING REGULAR MAINTENANCE IS ESSENTIAL. MAINTENANCE SHOULD ONLY BE CARRIED OUT BY EXPERIENCED MAINTENANCE PERSONNEL.

It is impractical to dictate any sort of time schedule between maintenance inspections, as production conditions will vary. However, maintenance must be carried out at very regular intervals. Any items requiring attention should be dealt with as soon as possible to prevent further damage. Listed in this section are checks that should be made on items not manufactured by Baker Perkins.

Heaters and Thermocouple Leads

These should be inspected periodically for coatings and corrosion. If they require cleaning be sure to isolate the electrical supply. Also See “Electrical Heater Maintenance” on page 123.

Water Lines and Fittings

Particular care must be taken to ensure any water leaks are located and repaired as soon as possible. Water leaks in the vicinity of electrical equipment should be repaired immediately, ensuring firstly that the electrical supply is isolated.

Seals and Gaskets

Replace any seals or gaskets that show signs of deterioration or damage. When assembling ensure that any nuts etc., are tightened evenly so that the seal and housing are drawn square to the shaft.

Bearings

When replacing a bearing always give it a light coating of lubrication before inserting it into its housing. This ensures that the bearing does not run dry in the first few minutes of "start-up".

General

For maintenance of proprietary items such as the main drive, screw feeder, cooling unit etc. - see manufacturer’s separate manuals.

CAUTION *When dismantling the barrel and associated parts, do not use screw drivers, chisels, wedges or hammers to dismantle components or to split barrel halves. Always use jacking or tapped holes provided.*

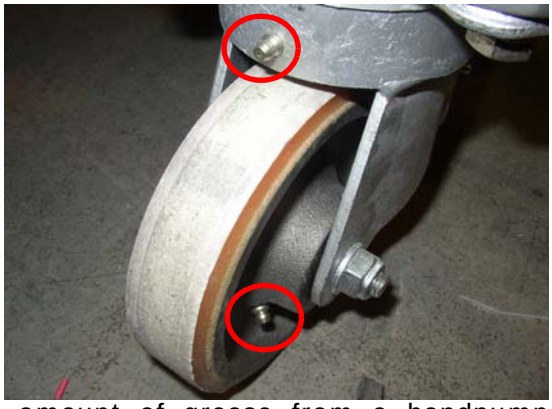
Extruder

The extruder itself requires little routine maintenance apart from the self lubricated bronze bushings sited at the agitator coupling end of the barrel assembly. These bushes are subject to wear and should be replaced at regular intervals.

- See also Product Cutter

19.3 Areas that may require periodic lubrication

Grease Points



Apply a small amount of grease from a handpump to any nipples as required.

19.4 Procedure for Opening Barrel

CAUTION *Extreme care must be taken by all personnel working on an extruder if the barrel is at normal operating temperature (above 200ºC). Wear appropriate safety gloves and glasses.*

1. If barrel is to be opened for cleaning it should be purged out to remove most of the residual product.
2. Maintain barrel temperature at all times whilst opening barrel.
3. Swing open the cutter assembly, remove the pressure transducer and discharge die assembly.
4. Lift the top cover, remove socket head capscrews along length of barrel and capscrews attaching barrel top half to gearbox.
5. Barrel top half can now be hinged open.

19.5 Procedure for Closing Barrel

CAUTION *Ensure that all mating machined faces are absolutely clean. Be especially careful not to damage the machined faces with hard tools or scrapers (face damage can lead to product leakage and other process problems).*

1. Close barrel top half, lightly pinching together with two capscrews in centre of barrel.
2. Replace, but DO NOT TORQUE UP capscrews attaching barrel top half to gearbox.

Note It is important that the barrel liner faces at the discharge end are flush and square with each other.

3. Replace all socket head capscrews along length of barrel and tighten to recommended torque, working from the centre to both ends, while alternating sides.
4. Torque up capscrews attaching barrel top half to gearbox - See “Tightening Torques” on page 137. Close the top barrel cover.

Note

Care should be taken to progressively tighten any bolts to ensure square seating, sealing and an even load distribution.

5 Replace discharge adaptor, tightening the screws to the correct torque setting.

6 Refit the pressure transducer.

7 Swing the cutter assembly back in front of the barrel and lock the toggle clamp. Wind the cutter to the back position.

19.6 Inspection of the Extruder Barrel and Agitators

Note

For visual inspection only, steps 1 and 2 apply. For visual inspection and clearance checks, follow the entire procedure.

1 Before any meaningful inspection can be made, the die and transition plate should be removed and cleaned, the barrel and agitators should be thoroughly cleaned (Be careful that the cleaning process does not contribute to any damage that may already be present).

2 Make a visual inspection of barrel interior and agitators for any scoring, nicks, gouges or excessive wear which could affect the process performance (Particularly in the discharge screw area since this is the bearing support area for the agitator).

3 If the agitators have been removed for cleaning these should be replaced at this stage - see below.

4 The agitator to agitator, and agitator to barrel clearances can now be checked.

5 It is advised that detailed inspections be documented and filed for future reference.

6 If all clearance checks are satisfactory and no replacement of parts is required, the top barrel half can now be closed.

19.7 Procedure to Remove Agitator Segments and Shafts

1 Follow procedures for opening barrel.

2 If desired, the agitator segments may be dismantled "in situ" leaving the inner shafts undisturbed.

TIP

Take a photo of the original configuration, this may be useful if subsequently the configuration is changed.

Before attempting such work, make a careful note of the relative positions and orientation of all the components on both agitator shafts. Removal of the capscrew in the end of the agitator shaft will now permit all the components to slide off the agitator shaft. Since the agitators are "in situ" and timed, two segments will have to be removed simultaneously (opposing segments on each agitator).

To remove, tap on each segment using a lead or copper mallet, brass bar or wooden block. Alternate impacts from one segment to the other.

After the removal of each segment pair, carefully clean the exposed shaft of any residual product, imperfections or other contaminants which may inhibit segment removal. Be sure that cleaning utensils are "softer" than the parts being cleaned.

Note

Any excessive impact during agitator segment removal should be avoided, as this could result in bending the agitator shafts, or cracking of hardened agitator segments.

3 The agitator shafts are now held in couplings. Loosen agitator retaining setscrews in couplings (*The setscrews retaining the couplings to the gearbox do not need to be loosened*).

19.8 Procedure to Replace Agitator Segments and Shafts

Note

Prior to replacing agitator shafts and segments, ensure thorough cleanliness of mating faces. Failure to do this will lead to subsequent process difficulties.

1 The shaft should be thoroughly cleaned and coated with anti-seize before fitting segments.

2 The agitator segments should be re-assembled by following the reverse of removal procedure. Check that segments have equal clearance in respect to each other throughout their length.

CAUTION

It is very important that when re-assembling the agitator configuration, that the block paddle segment is re-fitted in the same position as originally supplied, i.e. at the beginning of the first paddle section, immediately after a feedscrew.

19.9 Replacement of Barrel Liners

To ensure that the barrel liners are assembled correctly, and that the subsequent realignment of the new barrel assembly with the drive gearbox is satisfactory, it is strongly recommended that the barrel liners are replaced by a Baker Perkins service engineer for trouble free operation.

19.10 Splitter Gearbox

- For lubrication see “Extruder Lubrication” on page 58.

To ensure that the gearbox is assembled correctly and that subsequent timing and realignment of the output shafts is correct, it is strongly recommended that all maintenance work on this splitter gearbox is performed by a Baker Perkins service engineer.

19.11 Electrical Heater Maintenance

Replacement of Extruder Heaters

The electric heaters are of the Cartridge type. Special stainless steel flexible metal hose, with high temperature leads have been provided for optimum life.

Refer to the schematic electrical wiring diagram for method of wiring to balance power in each zone. All leads have been tagged and are wired to terminals in the machine junction box.

The following steps must be observed when removing original heater for replacement:

1 **Check that all power is locked OFF** before removing the junction box cover.

2 Disconnect leads from terminal block.

3 To remove the heater; remove the retaining circlips, use a small diameter round bar to apply pressure to the opposite side of the heater. (*Holes for heaters have been drilled through the extruder barrel*.)

Note

If you experience difficulty in removing cartridge heater contact Baker Perkins for further information.

4 Loosen the compression gland that secures the heater stainless steel flexible metal hose, at the entrance of the junction box. The existing compression gland can be used with the replacement heater.

5 When replacing heater apply WATLOW Watlube (see the OML Section) heater release agent or equivalent before inserting in the barrel. This will prevent heater seizure.

Maintenance of Other Maker's Parts

For maintenance of the following items, see manufacturer's separate instructions - See "Index of Other Makers Leaflets" on page 173.

- Drive Motors/Gearboxes
- Feeder Unit
- Barrel Cooling Unit.

19.12 Water Chiller Maintenance (if supplied)

1 Check coolant level periodically and top up if necessary. (Always use a suitable water/anti-freeze mixture.) Refer to the Manufacturer's separate manual.

2 If frequent topping up is required, i.e. excessive coolant loss, check for leaks.

3 Refer to the Manufacturer's separate manual for maintenance.

19.13 General Repair Instructions

Note

Prior to beginning the disassembly of any assembly or subassembly, be sure that the Baker Perkins warranty is no longer in effect. Unauthorized disassembly will void any pre-specified contract assurance, explicit or implied.

1 First, get all relevant assembly drawings associated with the particular subassembly to be disassembled. Carefully inspect, familiarise yourself with and review these drawings.

2 Read carefully all of the general installation and maintenance instructions on the total line piece of equipment, before beginning to disassemble.

3 Read the total disassembly instruction on the particular subassembly to be taken apart prior to disassembling anything. Review the assembly drawings while reading these instructions and familiarise yourself with the parts to be disassembled.

4 Review the maker's instructions for any purchased component which has to be removed from the Baker Perkins assembly for inspection and/or replacement, such as bearing instructions, seal instructions, coupling instructions etc. See "Index of Other Makers Leaflets" on page 173. Adhere to the recommendations of the particular manufacturer of the item for removing, inspecting and replacing the item in the subassembly.

5 Be certain the slings and other types of holding and lifting devices are of adequate capacity for the parts to be removed.

6 Follow all the rules of good housekeeping and cleanliness when working on the disassembly and reassembly of a piece of equipment.

7 Thoroughly clean all parts that are disassembled.

8 Replace all seals and gaskets which show signs of deterioration and damage.

9 When reinstalling bearings in a gearbox or bearing housing, always coat the bearing with a light coat of lubrication on installation so that the bearing will not run dry in the first few minutes of start-up.

10 Lip type seals require lubrication to keep them from burning up and destroying themselves. When replacing lip type seals, always apply a thin film of lubricant on the seal lip where it will run on the rotating member at installation.

11 Whenever a major component of the piece of equipment has to be removed for disassembly purposes, alignment of couplings and shafting should always be rechecked on re-installation of this subassembly with the main unit.

WARNING NEVER REMOVE GUARDS OR PROTECTIVE DEVICES ON THE PIECE OF EQUIPMENT UNTIL YOU ARE CERTAIN THAT THE PRIME MOVER HAS BEEN LOCKED OUT OF THE SYSTEM AND THERE IS NO POSSIBILITY OF AN ACCIDENTAL START WHILE YOU ARE WORKING ON THE MACHINE.

12 Whenever disassembling and moving heavy pieces of equipment, stay clear of pinch points. Be certain that the devices used to handle and lift the equipment are of adequate capacity to carry the load.

13 Piloted and tight fitting components on the major piece of equipment are usually provided with jack screw holes for disassembly purposes. Be certain to use jacking screws to remove these components. Never hammer or beat on a tight fitting piece to remove it.

14 Bearings should always be set up on reassembly with the end play as specified by the bearing manufacturer, unless otherwise specified on Baker Perkins assembly drawings.

The two main rules whenever working on a piece of equipment are safety and cleanliness. Adhere to these rules diligently.

20 Standard Lubrication

Note

Baker Perkins recommend the use of NSF authorised synthetic Food Grade lubricants, for all components where incidental food contact may occur. Note that the lubrication charts that follow, detail both NON Food Grade and Incidental/direct Contact Food Grades lubricants.

- For more info - www.nsf.org

20.1 General

Regular lubrication, using lubricants of the correct specification and in the correct quantities and locations, is essential for the reliable operation and long service of the equipment.

It is extremely important to use only high grade lubricants of the correct viscosity and specification, and to check and change them at the recommended intervals. Where possible, mixing of lubricants should be avoided.

Initial Running

CAUTION

Before first starting any machine, each gearbox, oil bath etc., must be checked and, if necessary, filled to the correct level with a recommended lubricant. A careful check should be made to ensure that all lubrication requirements have been carried out.

Refer to the Recommended Lubricants, Lubrication Details and Other Maker's Leaflets section for further information.

20.2 Bearing Lubrication

Ball/Roller Bearings with Provision for Relubrication

Packed with grease at assembly, these bearings need little further attention other than the occasional addition of a small amount of grease. If examination becomes necessary, clean and flush out the bearing with an environmentally safe, approved quick drying solvent and if the bearing is serviceable, re-pack with new grease.

Note

Do not pack the bearing too tightly with grease as this can cause overheating and possible breakdown of the bearing. The ideal is to have a little grease always in contact with the races.

Sealed Ball Bearings

This type of bearing is lubricated for the life at the time of manufacture and no provision is made for relubrication. If the bearing is running loudly it should be replaced rather than refilled.

NSK - RHP Self Lube Bearings

These bearings are factory charged with the correct type and quantity of grease at the time of manufacture and seldom require recharging.

If the bearings do however require more grease, (due to excessive loads or operating temperatures for example), they can be recharged with two or three shots of grease chosen from the Recommended Lubricants chart through the hydraulic grease nipple provided.

20.3 Recommended Lubricants

This is a general list of lubricants.
Reference should also be made to the Other Maker's Leaflets for lubrication information on equipment not of Baker Perkins manufacture.

Baker Perkins cannot recommend the use of any type or grade of lubricant not quoted by either themselves, or where applicable by the manufacturer of the specific piece of machinery.

Although for a particular application equivalent grades from different manufacturers are specified, this does not mean that the lubricants are identical in all respects.

Note

The mixing of lubricants should always be avoided.

Note

If abnormal operating conditions exist and you are in doubt of what lubricant to use, consult Baker Perkins for advice at the address given in this manual.

The recommended lubricants are listed in the following categories:-

- Lubrication Oils - Industrial Grade, food contact/non contact grades
- Lubrication Greases - Industrial Grade, food contact/non contact grades
- High Temperature Greases

CAUTION

Always check a lubricants specification against local regulations before use.

20.4 Lubrication Oils - (Industrial Grades)

Application	Temp °C	Food Contact Grades	NON Food Grade
Oil cans Transmission Chain High Speed Gears	Up to +50	Mobil SHC 150 Fuchs Cassida Fluid HF 100 Castrol Optileb GP 150 3575 or Castrol Optileb Chain Spray Rocol Foodlube Hi-Torque 150 or Rocol Foodlube Chain Spray Kluberoil 4 UH1 - 150N	Shell S2 G 100 Mobilgear 600 XP 100 BP Energol CS 100 Rocol Sapphire Hi-Torque 100 Kluberoil GEM 1 - 150
High Speed Gears	50 - 80	Mobil SHC 220 Fuchs Cassida Fluid GL 220 Slipstream CGL 320 Castrol Optileb GP 320 Rocol Foodlube Hi-Torque 320 Kluberoil 4 UH1 - 220	Shell S2 G 220 Mobilgear 600 XP 220 BP Energol CS 220 Rocol Sapphire Hi-Torque 220 Kluberoil GEM 1 - 220
Medium Speed Gears Slow Speed Gears High Speed Worm Gears Oil Cans Transmission Chains	50 - 80	Mobil SHC 460 Fuchs Cassida Fluid GL 460 Slipstream CGL 320 Castrol Optileb GP 320 Rocol Foodlube Hi-Torque 320 Kluberoil 4 UH1 - 460N	Shell Omala S1 W 460 Mobilgear 600 XP 460 BP Energol CS 460 Rocol Sapphire Hi-Torque 460 Kluberoil GEM1 - 460
Conveyor Chain Air Line Lubricators Small Hydraulic Pressure Systems	Up to +70	Mobil DTE FM 32 Fuchs Cassida Fluid HF 32 Rocol Foodlube Hi-Power 32 Kluber Summit HySyn FG 32	Shell Tellus S3 M 32 Mobil DTE 24 Saphire Hi-power 32 Kluber Airpress 32
Light Grade Food Quality Oil	Up to +70	Shell Ondina 917 Rocol Foodlube Hi-Power 32 Kluberoil 4 UH1 - 15 AAK Wundrol 100	
Heavy Grade Food Quality Oil (Incidental food contact)	Up to +70	Mobil SHC 460 Shell Ondina 934 Rocol Foodlube Hi-Torque 320 Kluberoil 4 UH1 - 320N AAK Wundrol 200	

20.5 Lubrication Greases - (Industrial Grades)

Application	Temp °C	Food Contact Grades	NON Food Grade
Grease Guns Stauffers Rolling Bearings	Up to +130	Mobilgrease FM 222 Fuchs Geralyn SG 2 Slipstream TW 2 GEL Rocol Foodlube Universal 2 Klubersynth UH1 64 - 62	Shell Gadus S2 V220 Mobilgrease XHP 222 BP Energrease HTG2 Castrol Spheeril EPL2 Rocol Sapphire 2 Kluberplex BEM 41 - 132
Rolling Bearings	130 - 185	Mobilgrease FM series Fuchs Cassida HDS 2 Slipstream TW 2 GEL Castrol Vitalube HT 2 Rocol Foodlube Hi-Temp Grease 2 Klubersynth UH1 64 - 62	Shell Gadus S5 V100 Mobiltemp SHC 100 BP Energrease LS3 Rocol Sapphire Premier2 Kluber Petamo GHY 133N
Open Gears		Mobilgrease FM series Fuchs Geralyn SG 2 Slipstream TW 2 GEL Castrol Vitalube HT 2 Rocol Foodlube Multi Paste Klubersynth UH1 84 - 201	Shell Gadus S3 OG Mobil SHC 680 BP Energrease OG Rocol Tuflube Allweather Kluber Grafloscan CSG 0 Ultra
Lift & Tilt Screws		Mobilgrease FM 222 Fuchs Geralyn SG 2 Slipstream TW 2 GEL Castrol Vitalube HT 2 Rocol Foodlube Universal 2 Klubersynth UH1 84 - 201	Mobilgrease XHP 322 BP Energrease LS3 Castrol Spheeril EPL2 Rocol Tuflube Allweather Kluberpaste ME 31 - 52
Food Quality Grease (Incidental food contact)		Mobilgrease FM series Fuchs Cassida RLS 2 Fuchs Cassida EPS 2 Slipstream TW 2 GEL Castrol Optimol Obeen UF Rocol Foodlube Universal 2 Klubersynth UH1 64 - 62	

20.6 High Temperature Greases

Standard

Supplier	Type
BP Oil	Energrease HTG2
Castrol	Firetemp XT 2
Kluber	Petamo GHY 133 N
Mobil	Mobilgrease 28
Rocol	Sapphire Premier2
Shell	Darina R2 (UK only) Darina RL2
Texaco	Ultra Temp

Food Contact Grades

Supplier	Type
BP Oil	None approved to USDA H1
Castrol	Obeen UF 2
Duckhams	None approved to USDA H1
Fuchs	Cassida HDS2 +165°C
Kluber	Kluber Paraliq GTE 703
Mobil	Mobilgrease FM 102 +200°C
Rocol	Foodlube Sapphire Endure +280°C
Slipstream	TW 2 Gel +200°C

CAUTION *None of these recommended high temperature greases should be mixed or used with any other make or grade of grease. If there is any doubt before using, ensure that the components are thoroughly cleaned of any existing grease.*

TIP It is strongly recommended that a separate grease gun containing a special high temperature grease is used for that one grease and no other. Always have separate marked guns for food grade and non food contact greases.

20.7 General Lubrication Schedule

It is essential that a lubrication schedule for the equipment is put in place and implemented by the user.

The required frequency of lubrication checks and changes is dependant upon the operating conditions of the equipment. The following schedule is given as a guide which will be appropriate for most installations. However the frequencies should be amended if the equipment operates continuously and / or in a harsh environment, for example high ambient temperatures.

Item	Frequency	Lubricant
Heavy Duty Gears	Every Day	Lubricate/Grease
Driving Chains	Every Week	Oil as required
Light Duty Gears	Every Week	Lubricate/Grease
All Gearboxes	Every Week	Check oil levels and replenish if necessary
Fan & Motor Bearings	Every Three Months	One or two shots only of the appropriate grease
All Gearboxes	Every Six Months	Change the oil
Bronze Oil-Retaining Bushes	Every Six Months	Apply oil liberally, allow some to be absorbed by the bush, then clean off the surplus oil.

20.8 Lubrication Table for SEW Drives

Many of the machines supplied by Baker Perkins are fitted with geared motors/gearboxes manufactured by SEW Eurodrive. On the next page is the SEW standard lubrication table that details lubrication manufactures equivalent grades.

- For SEW Lubrication Table - **CLICK HERE**

21 BCU Maintenance & Water Quality

General

- The Barrel Cooling Unit is a closed loop system - see the separate manufacturers manual Tricool (ICS) for more detail.

Note

Avoid any build-up of sludge and scale in the pipework and cooling channels as this will prevent the system from operating at maximum efficiency.

CAUTION

***DO NOT** use **MAINS TAP WATER** by itself in the cooling unit closed loop system as this will cause corrosion.*

CAUTION

***DO NOT** use **ANTIFREEZE** in the cooling unit closed loop system as fumes could ignite due to the high operating temperature.*

If there is a possibility of freeze-up - drain the system when not running.

Pre-commission Barrel Cooling Unit

It is advisable to flush the system through with a mild pre-commission cleanser to remove any residual light rust or lime. Use a proprietary additive e.g. Fernox IC-20 or equivalent; circulate for 2 hours, then rinse with plain water.

Running Barrel Cooling Unit

Fill the system with clean water (De-mineralised). Some end users may also wish to add an anti-scale/corrosion additive; Baker Perkins recommend that it is a H1 food grade product.

Note

If the system requires "topping-up" always use a water/additive mixture.

Preventative Maintenance

Drain and flush the system every 12 months, see the separate manufacturers manual for more detail.

Refill

- See the separate manufacturers manual.

Note

For installation and start up instructions of barrel cooling unit, see separate Tricool user manual.

21.1 Water Quality & Treatment

Water Softening Devices

When the MPF24 Extruder is to be installed into an area with high levels of calcium and magnesium in the water, the addition of a suitable water softening system is recommended and should be incorporated into the process water to abolish the possibility of Lime-scale linked process problems and component failure.

Which Softener?

There are a multitude of different softeners to be found on the market, all of which fit into three basic categories. Each type has its own merits and problems, all of which are highlighted in the following paragraphs.

Category A - Filters

Most filters are of similar shape to a standard oil filter, although larger and a little more robust. They tend to consist of a "Cap" in which the process flow and return fittings are housed, and a Filter Element containing a chemical resin through which the process flow must pass.

The filters tend to be the cheapest water softeners per unit cost but when used in a process with a large consumption of water they soon need replacing and therefore in the long term can work out the most expensive.

Category B - Chemical Additives

These type of softeners tend to be quite simply added to the reservoir feeding the process system. They have to be added in precise amounts to prevent over addition which can cause wastage, or under addition which can cause the water to be un-softened.

The chemicals themselves are relatively inexpensive but due to the extensive monitoring required to maintain the correct chemical levels, many suppliers tend to only recommend this type to clients with vast quantities of circulating water.

Chemical levels are established by tablets which change colour depending on the chemical content. Systems that run from process to drain are therefore difficult to monitor and also expensive to keep supplied with chemicals.

Category C - Water Softening Modules

The final category is by far the most extensive and has the greatest versatility. Water softening modules usually come as self contained units which may vary in size and throughput depending on process consumption. Most are maintenance free with only occasional addition of salt or salt tablets to the brine feed reservoir.

The units usually contain one or more crystal or resin capsules through which the process flow must pass to become softened. The capsule becomes saturated with "SCALE" over a period of time and must be regenerated using a salt-water (brine) solution. It is this regeneration procedure that tends to vary from one supplier to another.

Some systems rely upon an electric timer to indicate when the capsules need regenerating and a period of trial and error is needed to establish optimum times between these periods. Other systems automatically switch between two capsules when ever throughput is affected sufficiently to stop water passing through one of the capsules.

In either case regeneration times vary between approximately 15 and 90 minutes and quantities of brine used during regeneration vary between approximately 25 and 50 gallons.

Water softening modules tend to be the most expensive as far as capital outlay is concerned but within a relatively short space of time they can more than pay for themselves with regard to maintenance, monitoring and replacement part costs.

A further bonus with a constant supply of soft water to a system is that they can in fact remove scale from an existing piece of equipment over a period of time similar to the time it took for scale to develop.

21.2 Water Jacket Corrosion Inhibitors

Not only is it important to ensure that the process water being used in the product is treated to prevent damage to the equipment, but it is also equally important to ensure that water being fed through the jackets of Baker Perkins equipment is also adequately treated.

Whether water is being circulated in an enclosed environment, or directed from the equipment to a drain facility, any corrosive elements in the water will eventually lead to failure of the jacket; e.g. internal rusting breaking through to the outside, eventually causing leakage.

The rate of corrosion will vary dependent upon a wide variety of factors, but as long as there is either oxygen or chlorine in the water, or the system contains mixed metals which can form anodes and cathodes, then treatment with inhibitors is vital.

During installation, it is strongly recommended that advice about water treatment is sought from a reputable company, in order that they can examine the particular application and the problems contained therein, before offering a solution. Baker Perkins recommend contacting for information on suitable products:

Fernox Manufacturing Co. Ltd.
Saffron Walden,
England.
Phone +44 (0)1799-550811
Fax +44 (0)1799 550853
email technical@fernox.com

22 Tightening Torques

The following pages give the recommended tightening torques for use with the barrel assembly and discharge assembly.

Selection of tightening torque required is made by identifying the particular fixing to be tightened. To aid selection each page has an appropriate sketch. Reading across the page gives the bolt size and the required tightening torque.

Baker Perkins recommend that fixings utilised on the twin screw extruder barrel assembly are replaced every 5000 hours, or every year whichever occurs first. Fixings should only be replaced with those supplied or specified by Baker Perkins.

To ensure correct tightening torques, all fixings should be cleaned and lightly oiled before re-use.

Agitator Retaining Screws

Note

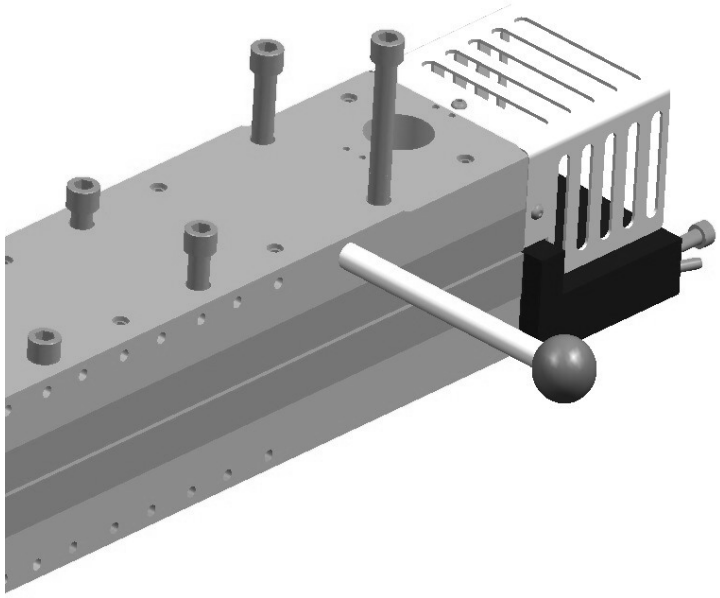
These are M6 X 16mm stainless steel cap head screws. These should be hand tightened using a standard length allen key.

22.1 Barrel Split Line Bolts

Machine Size	Bolt Size	Tightening Torques	
		Nm	Ft lbf
MP24	M12	55	41

See tightening procedure instructions

Physically check bolt before applying torque

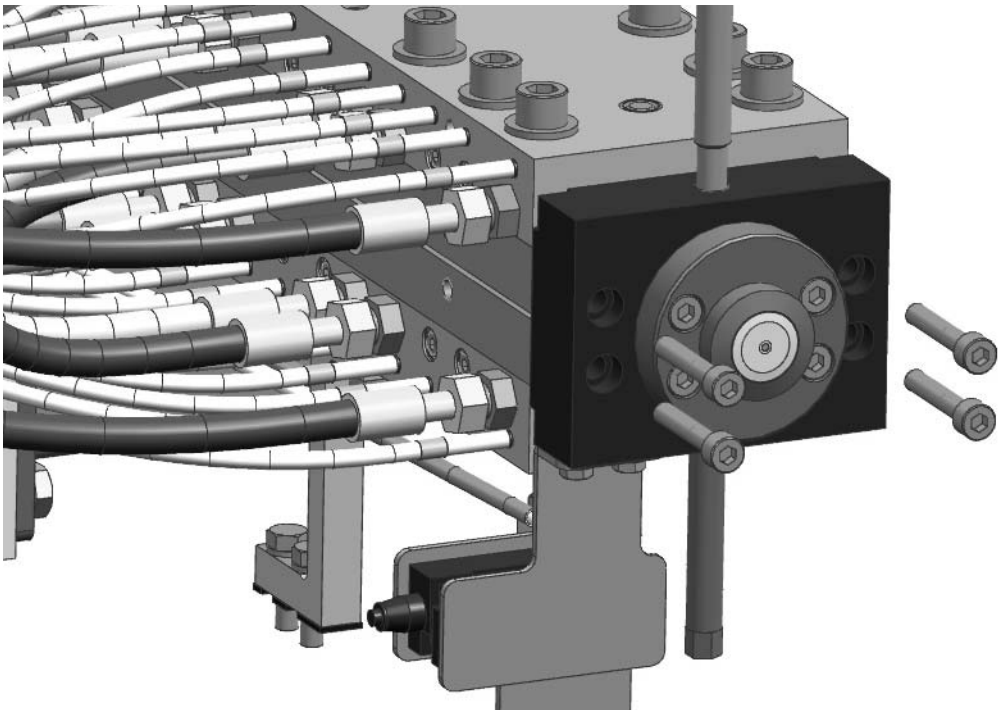


22.2 Discharge Attachments to Barrel Assembly

Machine Size	Bolt Size	Tightening Torques	
		Nm	Ft lbf
MP24	M8	27	20

See tightening procedure instructions

Physically check bolts before applying torque

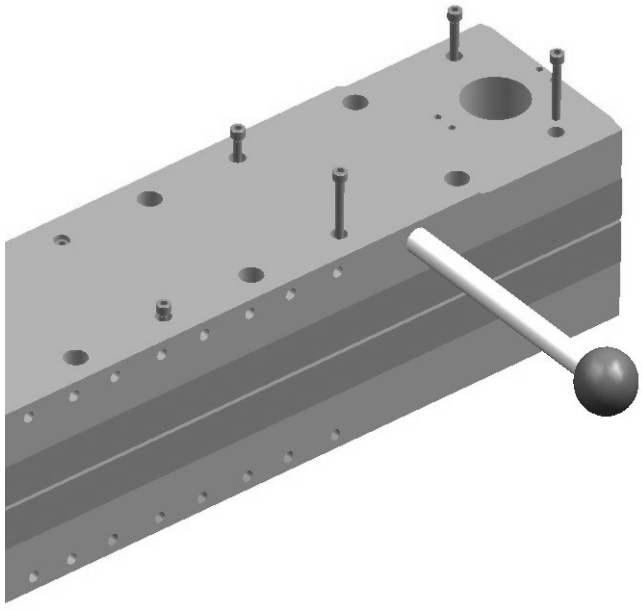


22.3 Circulation Block to Liner (Where Applicable)

Machine Size	Bolt Size	Tightening Torques	
		Nm	Ft lbf
MP24	M5	4.2	3.1

See tightening procedure instructions

Physically check bolt before applying torque

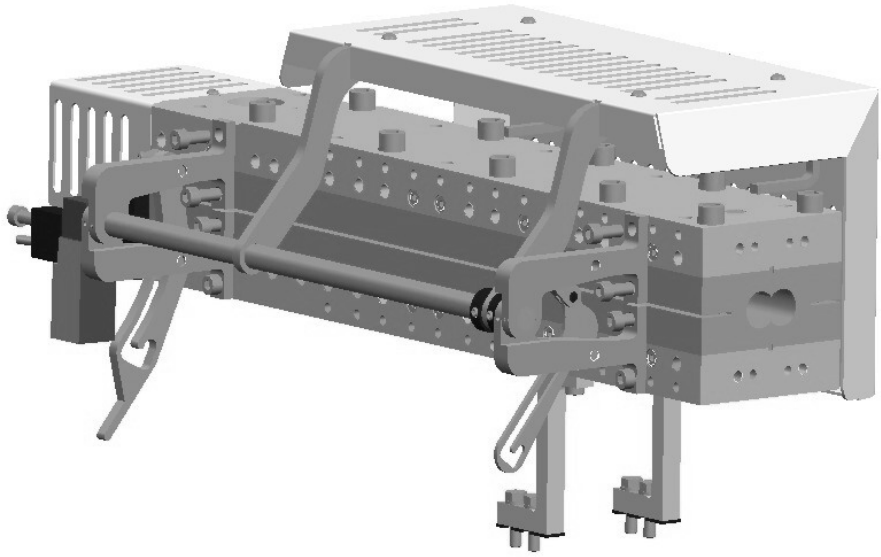


22.4 Hinge to Barrel Arm Assembly

Machine Size	Bolt Size	Tightening Torques	
		Nm	Ft lbf
MP24	M6	10	7.4

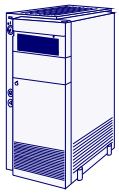
See tightening procedure instructions

Physically check bolt before applying torque



23 Programmable Logic Controllers

Overview



Programmable logic controllers (PLCs) fitted to Baker Perkins machines are used to control the movements of electro/ mechanical components as required by a recipe. A PLC is a solid state logic control device for industrial applications. As the term “programmable” implies, its programme (memory) can be readily changed to meet changing application requirements.

CAUTION

The PLC should only be reprogrammed by Baker Perkins. The effect of even small programme malfunctions can be difficult to predict and should be carefully executed by trained engineers. There is a danger of the equipment operating in an unsafe manner if the control programme is modified.

The PLC continuously monitors the status of the devices connected as inputs. Based on the installed program, the PLC controls the devices connected as outputs. These input and output devices (I/O devices) can be of different types with various voltage and current ranges.

The PLC stores all I/O device status data in a central memory. This allows the latest status to be accessible during the scanning of the user program. PLC programming instructions also make possible communication with other systems, operations such as timing, counting, arithmetic operations, comparisons and data manipulation.

On the various controller components are indicators that show I/O device, processor, and power supply status. These indicators aid in diagnosis of fault situations.

CAUTION

Read completely and understand fully the contents of this section on the PLC and the information from the PLC manufacturer, before attempting any service. Failure to do so could result in damage to the PLC and/or undesired operation with the possibility of severe injury to personnel.

PLC Hardware

The PLC used on the system is comprised of:

- The processor
- I/O racks
- I/O modules
- Terminal strips
- Auxiliary power supplies.

These components are enclosed in the electrical control panel to protect the equipment from dust and foreign material that could cause a possible malfunction.

The PLC is the controlling heart of the system. Input module signals are transmitted from the control and sensing devices on the equipment to the input modules and to the processor, which operates on this data in accordance with the user program. It then transmits signals to the output modules to operate the equipment.

Inside the PLC is the central processing unit. This unit's primary function is to provide:

- Control functions
- Timing
- Interfacing with other plant programmable controllers, control systems and data acquisition systems.

I/O Chassis

The I/O chassis is a single compact enclosure for the I/O modules that make up the I/O structure. Slots in the chassis allow for quick removal and replacement of the modules in the event of a failure.

CAUTION

Isolate system power before removing or installing a module in the I/O chassis. Failure to observe this warning could result in damage to the module and/or undesired operation with possible injury to personnel.

Indicators on the front of the I/O adapter module aid in trouble shooting. The indicators illuminate when proper communication is established between the processor and the I/O chassis. It also indicates that DC power is properly supplied to the I/O chassis.

The input module monitors the on/off status of the user input devices connected to it. Input signals can originate from limit, pressure and selector switches, and from push buttons, transducers, or other sensing or switching devices.

The output modules control the on/off status of the user output devices. Output signals can control various types of indicators, motor starters, solenoids, alarms and displays.

Each of the I/O modules have indicator that show the status of the input or output devices connected to them. These indicators are especially useful when trouble-shooting and monitoring.

Refer to the sequence of operation and programme listing to determine which indicators should be on at a specified time in the program.

Compact Flash (CF)

Within some PLCs the program can be backed up on a removable compact flash card located in the PLC. If the PLC memory becomes corrupted, the program will automatically be restored from the CF card. If the CF card is placed in a new processor, a programming terminal will be needed to transfer the program from the CF card to the processor.

Battery Backup

Some older types of PLC contain a battery that provides the back-up power to guard against loss of memory if power from the main power supply is interrupted.

If a non-rechargeable is fitted: Replace the battery at periodic intervals (as recommended by the PLC supplier) to prevent the battery from running down and causing memory loss if the main power supply is interrupted. When the 'Battery Low' indicator lights up, replace the battery immediately as further life of the battery cannot be predicted. To avoid loss of memory during battery changes, be sure the processor is receiving power and the memory module is firmly seated in the processor chassis.

The battery provides varying amounts of life depending on the amount of memory installed and the ambient conditions when the back-up is required.

Minimum life will be at least 30 days with the most memory installed at the worst ambient conditions. To be sure memory is not lost by loss of battery life; do not allow the power to the memory to be off longer than is necessary. Do not depend on the battery to maintain memory indefinitely.

CAUTION *Memory contents are altered if you remove the battery when the power supply is powered down or off. Memory must be re-entered if the data or program is lost. Contact Baker Perkins*

1 When the battery needs to be replaced, ensure the mains supply is isolated, open the access door, unplug the battery connector from the socket.

Note A capacitor will hold power and retain the PLC data for a few minutes; this will give adequate time to replace the battery.

2 The battery is held in the battery holder by a small retaining clip. Remove the battery from the holder by depressing the clip and sliding in up and out.

3 Insert a new or replacement battery in the holder making sure it is held in by the retaining clip.

4 Plug the battery connector into the socket with the white lead wire on top and the red lead wire on the bottom.

5 Be sure the replacement battery is equivalent to the original battery specifications.

PLC Trouble-Shooting

Programmable controllers are designed to minimize the need for maintenance and trouble-shooting procedures. Trouble-shooting the majority of controller faults requires no special test equipment or programming techniques. Instead, status and diagnostic indicators on the controllers help to isolate the source of a fault in the user's hardware or in the controller itself.

Note Most PLC system faults are caused by external failures. Be sure to check all connections to input and output devices. Check the operation of the I/O devices.

The PLC is an electrical system comprised of printed circuit boards that are vulnerable to damage by dirt, dust and moisture. Every effort has been made to protect this circuitry to limit its exposure to damaging elements. The processor modules are enclosed in the metal processor chassis; the I/O adapter module and the I/O modules are each enclosed in a tough plastic case.

The interior of the enclosure should be kept clean and the enclosure door should be kept closed whenever possible.

Periodic inspection of terminal strip connections, plugs, sockets and module connections should be made. Loose connections may not only result in improper functioning of the controller, but may also result in permanent damage to the components.

CAUTION *Turn off the main disconnect before inspecting the connections for tightness. Severe electrical shock to personnel or damage to the machine may result if the power is left on. Do not remove an I/O module with the system power turned on.*

TIP

Baker Perkins recommends that you stock a full set of spares. It is recommended that you stock 10% of the total number of each type of module, or at least one of each type of module as a spare.

A systematic approach should always be used when PLC trouble-shooting to diagnose and resolve a malfunction. Sometimes certain problems may be found and corrected with hasty, incomplete checks. This method could result in extended periods of down time if the problem was only solved on an interim basis.

- Always follow a step-by-step procedure in diagnosing a problem and resolving it completely.

The I/O modules have indicator lights for each remote I/O device. These indicators will be on when a signal is being sent or received by the address the terminal represents. These indicators may be used to follow the status of the remote devices as the controller operates.

If the controller is not operating properly, compare the sequence of operation to the status of the I/O devices. If the resulting output and the conditional inputs do not match the sequence of operation, check the field wiring and the condition and operation of the remote device(s). If the remote device and the field wiring are not at fault, the controller is at fault.

If all the remote devices and the field wiring check out, and the operation of the controller is still faulty, contact Baker Perkins for further diagnostic procedures.

CAUTION

Do not remove any module from the racks when the power is being supplied to the rack. Be sure the main disconnect is off and locked out before removing and replacing the power supply, controller, or I/O modules. Failure to follow this guideline may result in damage to the controller system.

If any module is being replaced, be sure the replacement module is the same as the original module and any specific setting (such as DIP switches) are set correctly. When the modules are replaced, be sure all wiring and terminal connections are secure and no damage is present. Be sure to mark any module that is being replaced so later identification of original (faulty) and replaced units may be made easily.

When trouble-shooting indicates that one or more modules may be faulty, check any interconnection and interaction between the two modules. This interconnection may be causing the problem.

Note

Replacement of the modules is not a recommended practice unless it is established that the module is definitely at fault, because it may mask the original cause of the problem. In some cases this may introduce other problems that may cause later trouble-shooting to be even harder.

24 MPF24 Extruder Cleaning

WARNING BEFORE ATTEMPTING CLEANING OF ANY DESCRIPTION ON THE EQUIPMENT ENSURE THAT YOU HAVE READ AND UNDERSTOOD THE SAFETY SECTION OF THIS MANUAL.

WARNING BEFORE ATTEMPTING CLEANING OF ANY DESCRIPTION ON THE EQUIPMENT ENSURE THAT IT IS ISOLATED FROM ALL POWER SOURCES:-
- ELECTRICAL SUPPLY.
- PNEUMATIC SUPPLY.
- HYDRAULIC SUPPLY.

ENSURE THAT THE LOCK OFF PROCEDURES HAVE BEEN APPLIED.
ENSURE THAT ANY EQUIPMENT WHICH OPERATES AT ELEVATED TEMPERATURES HAS COOLED TO A SAFE WORKING TEMPERATURE BEFORE STARTING WORK.
FAILURE TO CARRY OUT THESE INSTRUCTIONS COULD RESULT IN SERIOUS INJURY.

WARNING IT MAY BE POSSIBLE FOR THE EQUIPMENT TO APPEAR “SWITCHED OFF” BECAUSE IT IS NOT MOVING. TURNING THE SPEED CONTROL TO ZERO CAN CREATE THIS EFFECT ON EQUIPMENT THAT IS ACTUALLY STARTED. ALWAYS FOLLOW THE LOCK OFF PROCEDURES.

CAUTION *The MPF24 Extruder is not designed for wet washdown as some components are made from ferrous materials.*

24.1 Initial Cleaning (after installation)

Before despatch from Baker Perkins, all exposed polished parts and machined faces may have been coated with a Rust Preventative Treatment. See the datasheet for cleaning details.

CAUTION *All ferrous surfaces must be thoroughly dried after cleaning - failure to ensure all moisture is removed could result in corrosion.* ***THIS IS APPLICABLE FOR THE LIFE OF A MACHINE.***

24.2 Safety and Cleaning Equipment

Ensure that you have access to the correct safety and cleaning equipment and that it is clean and in good condition, such as the following items:

- Eye protection - goggles or safety glasses
- Rubber gloves
- Clean mop and bucket
- Scouring pads
- Non woven disposable cloths
- Hand scraper
- Hand brush
- Floor brush
- Compressed air line
- Proprietary cleaning solution
- Warning signs
  e.g. Slippery floor, Danger men at work, etc.

CAUTION EYE PROTECTION MUST BE WORN WHEN THERE IS THE RISK THAT DUST, DEBRIS OR CLEANING SOLUTIONS MAY DAMAGE THE EYES.

CAUTION GLOVES MUST BE WORN TO PROTECT THE HANDS WHEN USING CLEANING SOLUTIONS.

24.3 Cleaning Procedure

Purpose

To ensure that the operation or function of the machine is not impaired by product residues remaining in or on the machine after use.

Cleaning describes the process of changing a soiled surface to one that is free from process chemicals that may contaminate another batch. It involves the input of energy for a given length of time. The types of energy used in the process may be classified as:-

- **Mechanical -** the more energetic the application, the more effective the process.
- **Chemical -** the stronger the chemical, the more powerful the action.
- **Thermal -** the more heat means faster reactions.

Note

The user is responsible for implementing adequate cleaning procedures for the equipment and for safe working practice. The following notes are given for guidance only.

Overview

The choice of chemical agent required to clean or sanitise Baker Perkins machines has to be correct. The materials of construction, function and operation of the machine may be seriously damaged by unsuitable agents.

Because the range of products in terms of chemical types and formulation is vast, it is impossible to outline all the possible products and procedures required to clean Baker Perkins machines.

Because the possible choices and systems available are numerous it is important to contact a reputable supplier of cleaning chemicals who can advise on the correct products, equipment and systems required.

Procedure

Any equipment which presents an electrical or heat risk to hygiene operatives must be isolated from the power supply and heated surfaces cooled. If the cleaning method has to be carried out with electricity and heat in line then the correct health & safety measures should be enforced. It would be advisable to carry out a risk assessment for this purpose.

24.4 Access To Equipment For Cleaning

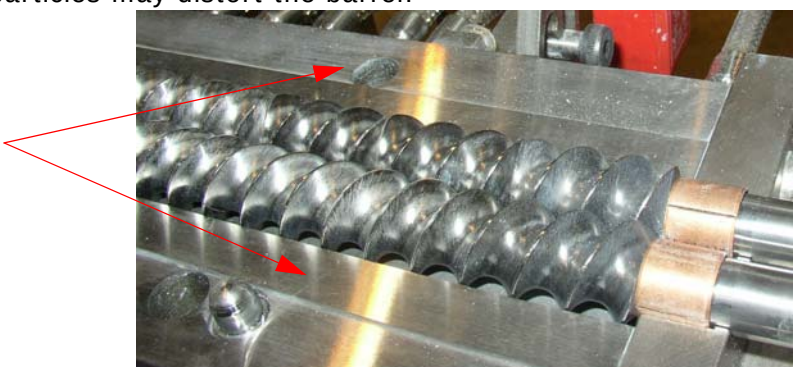
Note that gaining access to equipment for cleaning may expose various hazards. It is the responsibility of the user to assess any hazards and establish safe working practices accordingly.

For example, powders in a silo may present an explosion hazard due to air borne particles. Safety precautions must be implemented to avoid the risk of injury to personnel and damage to equipment.

The cleaning chemicals themselves are possible sources of hazards. Again, it is the users responsibility to assess the potential hazards and implement safe working procedures.

24.5 Barrel Faces

It is important to ensure that the mating faces of the barrel are clean and free from any product before the barrel is closed and torqued down. Any small product particles may distort the barrel.



24.6 The Cleaning Process

Main Steps to Hygienic Cleaning

- Remove debris
- Clean - by applying physical energy, chemicals or heat
- Clean/Sanitise and dry.

1 As much debris as possible should be manually removed from machine surfaces to include underneath and behind panels as build up of debris in concealed places can also lead to pest problems. The method chosen must not cause physical damage to the surface being cleaned.

2 Once debris has been manually removed, any fine debris may be removed with compressed air.

3 Wipe any parts that come in contact with a suitable sanitising agent. Remove any excess sanitising agent with a dry cloth.

24.7 Extruder Cleaning Procedure

The degree of cleanliness required is dependant upon the range of products that are required to be processed on any one particular Extruder. The cleaning operation can vary from a simple purge run with a suitable inert material to the opening of the Extruder barrel, removal of the agitator assemblies, and dis-assembly of all agitator components, thorough cleaning and re-assembly.

These activities may require the removal of the discharge die for purging and the further removal of safety guards to open the barrel and remove the agitator assemblies.

At the end of a normal shutdown sequence, the die normally needs to be cleaned. The die should be removed from the Extruder and the die inserts removed. Do not use metal scrapers to clean the die, only use a stiff brush and mild detergent solution to remove all traces of product. Rinse with clean water and dry thoroughly after cleaning.

If a washout chute is supplied; after removing the production die the interlocked chute should be fitted. Run the extruder at low speed to clear product, slowly introducing water (or a suitable liquid) to help remove product from the barrel and agitators.

1 The die assembly can be removed by unbolting it, see drawing SA13514. Before cleaning with a wire brush, pressure transducers must be removed - WHEN HOT - to prevent damage.

2 The extruder barrel can then be unbolted and the hinged barrel halves opened to allow access for cleaning.

WARNING THE BARREL TOP HALF MUST ALWAYS BE LOCKED INTO THE OPEN POSITION TO PREVENT POSSIBLE INJURY DURING CLEANING.

3 A wire brush can then be used to clean the agitators, rotating the input shaft as necessary. Wear gloves throughout the cleaning process as burrs may exist on the agitator parts.

4 If removal of agitator parts is desired, the discharge screw retaining bolts should be removed.

CAUTION *Be sure force is applied on the wrench with the barrel closed to avoid bending the agitator shafts.*

5 The agitator parts can then be slid off the shaft one section at a time. Be sure the exposed shaft is clean before attempting to remove the next slip-on component.

Note If the parts are difficult to remove, they may be gently tapped off with a block of wood or soft metal placed against the part.

6 Once removed, the parts may be wire brushed or placed in hot soapy water to soften hardened product, then brushed clean. An acid or chlorine cleaner should not be used since some extrusion parts are not stainless steel and may corrode.

7 Once the slip-on parts are removed, the barrel can be cleaned as required.

Do not use metal scrapers to clean the die, only use a stiff brush and mild detergent solution to remove all traces of product. Rinse with clean water and **dry thoroughly after cleaning**.

Dies

Extruder dies require a full strip down to clean adequately. Use a suitable stiff brush and a mild detergent solution to remove all traces of product from the die and rinse with clean water. Dry thoroughly after cleaning. NEVER USE METAL SCRAPERS TO CLEAN THE DIES.

CAUTION *Only use water, mild caustic solution or mild detergent for cleaning.*

Summary

The cleaning system chosen for Baker Perkins machinery requires careful consideration. The wrong system may cause damage to the control, working components and construction materials of the machine. It is important to consult with other parties involved when considering a *cleaning and disinfection system/practice,* for example:-

Baker Perkins / Engineers: they will know about the construction, safety and tolerance of working components and whether the machine will be able to withstand various chemical treatments.

The Chemical Supplier: the chemical supplier has experience in the types of products required to clean machinery and the required procedures.

Technical Managers: they need to be involved as they will be responsible for operatives carrying out the cleaning and disinfection procedure.

Laboratory Managers/QC: as they will be testing the machine for microbiological acceptance (pharmaceutical process) they need to be familiar with the procedure and how they can obtain their samples and determine test points.

Once the cleaning system/practices have been finalised, they should be incorporated into a control schedule for documentation purposes.

Further Points To Consider -

1 Ensure that all shut down and lock off procedures have been correctly carried out as detailed in the Safety Section.

2 Make arrangements for the necessary guards to be removed to allow access for cleaning.

3 Make arrangements for any necessary dismantling of the equipment to facilitate cleaning.

4 If using compressed air be aware that this will blow the deposits away but that they will end up somewhere else! If possible it is always best to collect deposits with a vacuum system.

5 Some items, once removed from the equipment, are best cleaned by using a steam lance.

WARNING ENSURE THAT SAFETY PROCEDURES FOR THE USE OF STEAM LANCES ARE IN PLACE AND ADHERED TO BY OPERATORS. STEAM CAN CAUSE SERIOUS INJURY.

TIP After cleaning a component with steam, wait for it to cool down before fitting it back into the equipment. The raised temperature may cause fitting problems with close tolerance components.

6 When the job is finished, clean all cleaning and safety equipment.

7 Arrange for equipment re-assembly and for the guards to be replaced.

8 Ensure that the equipment and surrounding area is left in a clean and tidy condition.

WARNING ON COMPLETION OF CLEANING PROCEDURES, ALWAYS ENSURE THAT ALL PERSONNEL ARE CLEAR OF THE EQUIPMENT. CHECK THAT ALL EQUIPMENT IS PROPERLY ASSEMBLED AND ALL SAFETY GUARDS ARE IN PLACE BEFORE TURNING ON THE POWER SOURCES.

25 Baker Perkins Spare or Replacement Parts

When ordering, please quote the following typical details:

Information	Example
The Machine Name	Conical Moulder
The Machine Number	AF11046-2831
The Description of the Part	Discharge Board - LH
The Drawing number or Code number of the part	PM11685
The Quantity Required	1

Quoting all the above will assist Baker Perkins to supply the parts quickly. The machine details can be found on the Machine Number Plate, example:

Use the parts lists and drawings to find the part details. If a required item is less clearly defined, please also quote the number of the picture drawing on which it is shown. Fax the drawing or sketch with the part highlighted can be useful in identifying the part. A photograph of the required part can be emailed to us.

Please contact the Baker Perkins Customer Services Department to discuss your requirements. Our experienced staff will help to service your requirements efficiently and will give you any assistance you may need.

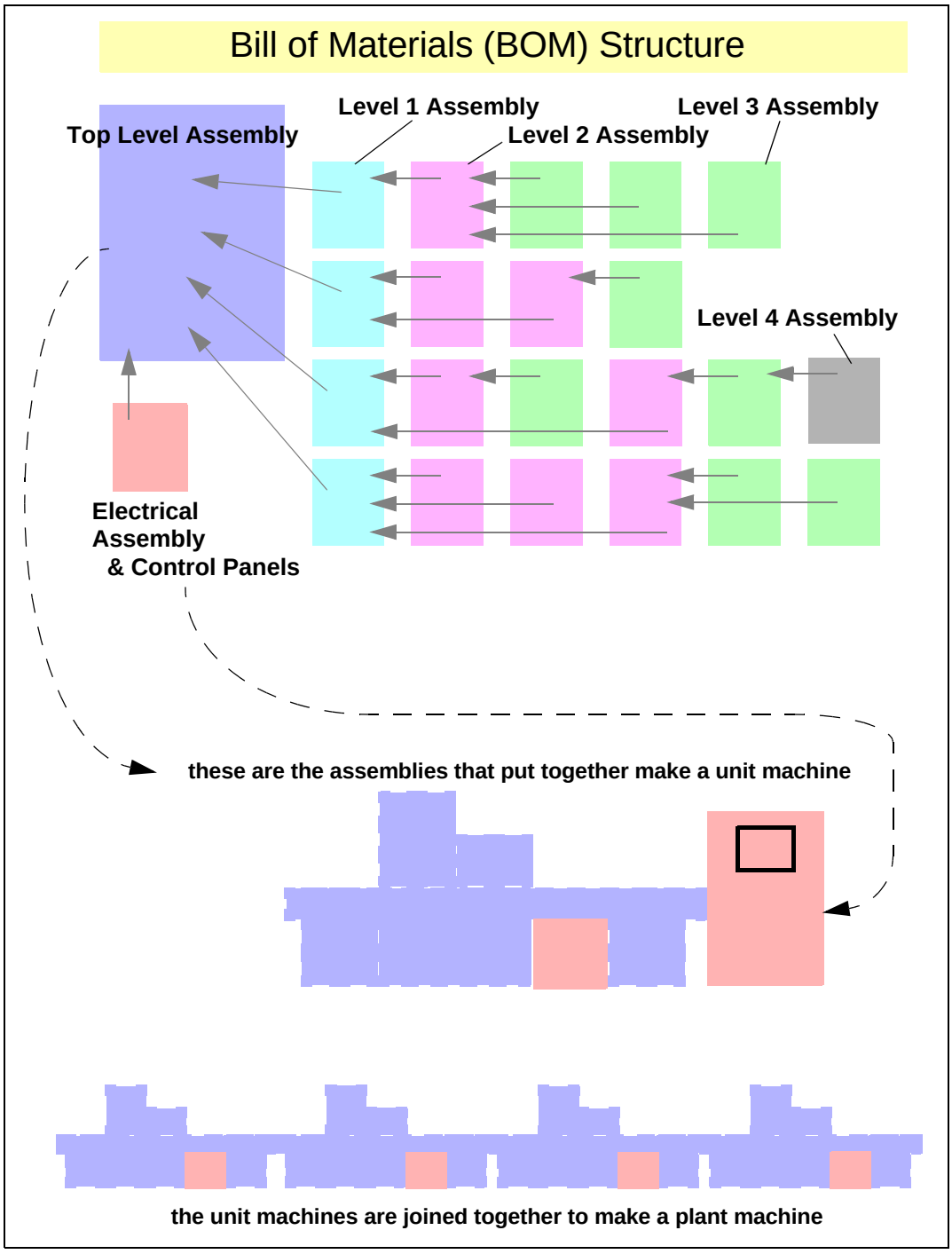
Contact Baker Perkins Support

World Support	USA Support
Baker Perkins Ltd. Manor Drive Paston Parkway Peterborough PE4 7AP - UK Phone: +44 (0)1733 283222 Fax: +44 (0)1733 283010 Email: bpltd@bakerperkins.com	**Baker Perkins Inc.** 3223 Kraft Ave. S.E. Grand Rapids MI 49512-2027 USA Phone: +1 616 784 3111 Fax: +1 616 784 0973 Email: bpinc@bakerperkins.com

25.1 Bill of Materials Structure

The Bill of Materials (BOM) details all units, their associated assemblies and components, down to level 3 or 4 plus the electrical assemblies / components. The individual BOM headers are colour coded to help finding things.

Adobe PDF Reader has a very useful search tool that can be used to search the manual and BOM for a sub-assembly or component. Try the name if you know it or it may be easier to view the assembly drawing first. On the assembly drawing try to identify the sub-assembly or component, make note of the bubble (Pos) number. Go back to the BOM assembly the drawing is picked up on, the bubble (Pos) number line will detail the sub-assembly or component.



26 Bill of Materials

For info on colour codes, see Bill of Materials Structure

Level	Assembly	Pos.	Part Number	Drawing	Description	Qty	UOM
	SF15125-2491-KA		SF15125-2491-KA	SL10741	Key Assembly - Clasen	1	EA
1	SF15125-2491-KA	1	SF15125-1401-KP	SA11904	26.1 Key Plan - Liquid Feed System - MPF24 Extruder	1	EA
2	SF15125-1401-KP	1	SP12831	SA11904	ASSY OF LIQUID FEED SYSTEM	1	EA
3	SP12831	1	SC17290		TANK STAND -	1	EA
3	SP12831	2	2325-595B		NYLON WHEEL 75 MM DIA CAT NO WNY-3 -	2	EA
3	SP12831	3	SC17294		WHEEL SPACER	2	EA
3	SP12831	7	9365405F		G-ADDITIVE CONTAINER	1	EA
3	SP12831	8	CC18674		MODIFIED ADDITIVE CONTAINER	1	EA
4	CC18674	1	9365405F		G-ADDITIVE CONTAINER	1	EA
3	SP12831	12	2476-6096H		BALL VALVE, ST ST 316 1/4"BSPP F/F BV2P	2	EA
3	SP12831	13	2452-6076H		ST.ST.BUSH 1/4" X 1/8" PART NO.SB2-SS	2	EA
3	SP12831	14	2468-031B		MALE HOSE ADAPTOR ST ST 316, 1/4"BSPT X 1/4"	2	EA
3	SP12831	15	2452-6513A		MALE HOSE ADAPTOR 1/4" BSP TO 4	2	EA
3	SP12831	16	2452-6514K		MALE HOSE ADAPTOR ST.ST.316 1/4	2	EA
2	SF15125-1401-KP	2	SP12832	SA11904	KEY PARTS LIQUID FEED SYSTEM	1	EA
3	SP12832	1	9387628H		NUMBERPLATE (ENGLISH) CE	1	EA

3	SP12832	2	9387892B		BAKER PERKINS LOGO 75MM WIDE	2	EA
					USE FOR WATER ONLY		
3	SP12832	3	1827-6827H		MARPRENE TUBE 1.6 MM BORE FOR 500 SERIES	12	M
					USE FOR VEGETABLE OIL		
3	SP12832	4	1827-6977L		MARPRENE TUBE 4.8 MM BORE FOR 500 SERIES	12	M
2	SF15125-1401-KP	5	SE3067		EPL; Liquid Feed System	1	EA
					*** LIQUID FEED PUMPS ***		
3	SE3067	10	2487-6094K		CONTROL PUMP TYPE 530 UN/R, IP66,	2	EA
					*** WATER TANK - LEVEL SWITCH ***		
3	SE3067	20	8192-6810K		Side Entry Stainless Steel Level Switch.	1	EA
3	SE3067	30	8192-6709K		Angled Cable 5M PUR, Halog	1	EA
2	SF15125-1401-KP	10	SE3068		S/O Conduit - Liquid Feed System	1	EA
					*** TERMINAL BOX ASSEMBLY *** NOTE: BOX TO MOUNT HOIZONTALLY WITH GLANDS & ANACONDA TERMINATED IN BASE OF ENCLOSURE		
3	SE3068	70	2521-7815E		TERMINAL BOX WITH PLAIN LID 280X220X85	1	EA
3	SE3068	76	2515-6451E		FEED THROUGH TERMINAL 1492-J3. GREY 2.5 MM2	30	EA
3	SE3068	78	2515-6447G		EARTH TERMINAL GREEN/YELLOW.	4	EA
3	SE3068	80	2515-6481G		SCREW CENTRE JUMPER FOR 1492-J3 TERMINALS	2	EA
3	SE3068	82	2515-6457D		SCREW CENTRE JUMPER FOR 1492-J3 TERMINALS	1	EA
3	SE3068	86	2515-6460D		MARKER TAG FOR 1492-J3 TERMINALS	30	EA
					*** COMPRESSION GLANDS FOR CONNECTION TO PUMPS ***		

3	SE3068	100	2517-6146J		CABLE COMPRESSION GLAND. TYPE SKINTOP ST.	6	EA
3	SE3068	104	2517-6061F		CABLE GLAND LOCKNUT M20 THREAD.	6	EA
					*** PLUG & SOCKET ASSEMBLY *** NOTE: UMBILICAL TO PLUG IN AT EXTRUDER		
3	SE3068	120	8165-6585E		ANGLED SIDE ENTRY HOOD M25 CONDUIT ENTRY	1	EA
3	SE3068	132	8165-6102G		MALE INSERT 24+E CONTACTS 09 33 024 2601	1	EA
					*** BULKHEAD FOR MOUNTING AT REAR OF EXTRUDER ***		
3	SE3068	160	8165-6558H		HOUSING BULKHEAD MOUNTING.	1	EA
3	SE3068	168	8165-6104C		FEMALE INSERT 24+E CONTACTS 09 33 024 2701	1	EA
3	SE3068	206	2532-6346F		2 CORE SCREENED CABLE 0.50MM UNITRONIC LiYCY	2	M
3	SE3068	218	2532-6346F		2 CORE SCREENED CABLE 0.50MM UNITRONIC LiYCY	10	M
1	SF15125-2491-KA	2	SF15125-7551-KP	SA13511	26.2 Key Plan - L.I.W Feeder - Support Assembly	1	EA
2	SF15125-7551-KP	1	SP14445	SA13511	Feeder Support Assy - Schenck - Accurate (Fe	1	EA
3	SP14445	1	SC23045		FEEDER SUPPORT ARMS - MP24PC	1	EA
3	SP14445	3	SC23053		PAIR OF FEEDER SUPPORTS - MP24PC	1	EA
3	SP14445	7	SC23054		FEEDER WASHER - MP24PC	4	EA
3	SP14445	15	SC23049		FEEDER SUPPORT - MP24PC	1	EA
3	SP14445	17	SC23056		SPACER - MP24PC	2	EA
3	SP14445	25	SC23063		LIMIT SWITCH BRACKET - MP24PC	1	EA
3	SP14445	28	SC23066		CONNECTING BLOCK - MP24PC	1	EA
3	SP14445	29	2821-6053F		THUMB SCREW ST.S WDS REF. 817-208-15	1	EA

3	SP14445	30	SC23065		FUNNEL - MP24PC	1	EA
3	SP14445	31	SC23067		FEED CHUTE - MP24PC	1	EA
3	SP14445	35	SM10894		AIR RELIEF SOCK	1	EA
3	SP14445	36	2468-6240L		Stainless Steel Hose Clip BS5315 - Size 90 (	3	EA
2	SF15125-7551-KP	5	SE3075		EPL; Feeder Signal Interface - Plug & Socket	1	EA
					*** BULKHEAD FOR MOUNTING AT REAR OF EXTRUDER ***		
3	SE3075	10	8165-6735A		Standard housing low construction bulkhead m	1	EA
3	SE3075	12	8165-702E		24 POLE FEMALE INSERT PART NO.09330242701	1	EA
					*** UMBILICAL FROM FEEDER TO PLUG IN AT EXTRUDER ***		
3	SE3075	20	8165-6585E		ANGLED SIDE ENTRY HOOD M25 CONDUIT ENTRY	1	EA
3	SE3075	22	8165-701G		24 POLE MALE INSERT PART NO.09330242601	1	EA
					*** FESC - Safety Contactor ***		
3	SE3075	40	8242-6498H		Contactor 5.5KW 3-Pole 1 N.O	1	EA
					*** CABLE ***		
3	SE3075	50	2532-6346F		2 CORE SCREENED CABLE 0.50MM UNITRONIC LiYCY	6	M
1	SF15125-2491-KA	3	SF15125-7221-KP	SA13503	26.3 Key Plan - MPF24 25:1 Extruder	1	EA
2	SF15125-7221-KP	1	SP14443	SA13509	Main Frame Assy	1	EA
3	SP14443	1	SC23042		MAIN FRAME - MPF24	1	EA
3	SP14443	2	2325-604E		SWIVEL CASTOR, LOCKING BZK150PTBSWB	4	EA
3	SP14443	5	2781-406		COLLAR EYEBOLT M24 TO BS 4278	3	EA
3	SP14443	6	NC10117		STOP BAR	1	EA

2	SF15125-7221-KP	2	SP14442	SA13512	Drive Parts Assembly - MP24PC	1	EA
3	SP14442	1	SC23061		GEARBOX COVER - MP24PC	1	EA
3	SP14442	2	SC23062		GEARBOX COVER - MP24PC	1	EA
3	SP14442	3	SC23055		DRIVE CASING - MP24PC	1	EA
3	SP14442	5	243-224N		AGITATOR COUPLING	2	EA
3	SP14442	6	E2499-207N		SPLITTER GEARBOX TO MP24 SS 5.5KW	1	EA
3	SP14442	7	2714-6109G		ROLLER CHAIN COUPLING REF.LRC5016, HUBS	1	EA
3	SP14442	12	2714-6112G		COVER FOR ROLLER CHAIN COUPLING REF.SA5016C	1	EA
2	SF15125-7221-KP	3	9X474-224P	11X460-224N	BARREL ASSY MP24 (25:1)	1	EA
3	9X474-224P	1	11X467-224N-5		LINERS 25:1 D2 NITRIDE HEAT TREATMENT	1	EA
4	11X467-224N-5	2	230-224N		LINER BUSH	2	EA
4	11X467-224N-5	3	231-224N		LINER BUSH	4	EA
4	11X467-224N-5	5	2047-5903L		INSERT THREADED M8 x M14 x 14 HEAVY ST ST 30	8	EA
4	11X467-224N-5	6	NC10508		LINER BUSH - MP24	4	EA
3	9X474-224P	2	233-224N		LOCATION DOWEL	2	EA
3	9X474-224P	4	11X466-224N		CIRCULATION BLOCKS	1	EA
4	11X466-224N	3	2426-5905H		PRESSURE PLUG 1/8-27 NPTF LEVEL SEAL	24	EA
4	11X466-224N	4	2467-6001C		SEALING PLUG REF.Z942/8 - HASCO	50	EA
4	11X466-224N	5	2622-6104B		HEADLESS DRILL JIG BUSH REF.WPP15E10 WIXROYD	2	EA
4	11X466-224N	6	2622-6105L		HEADLESS DRILL JIG BUSH REF.WPP15H10 WIXROYD	2	EA
3	9X474-224P	5	232-224N		THRUST DOWEL	2	EA
3	9X474-224P	8	NC10027		SPLIT BULKHEAD BOTTOM - MP24PC	1	EA

3	9X474-224P	15	NC10029		SPLIT BULKHEAD TOP	1	EA
3	9X474-224P	18	NC10030		SPLIT BULKHEAD TOP COVER - MP24PC CR100	1	EA
3	9X474-224P	20	2323-6025J		GEAR LEVER HANDLE - BALL KNOB. WIXROYD REF	1	EA
3	9X474-224P	21	NC10028		BARREL SUPPORT	2	EA
3	9X474-224P	23	NC10102		BRASS LAMINATED SHIM	2	EA
3	9X474-224P	26	2626-6050H		PERMAGLIDE PLAIN BEARING 15 X 17 X 15	2	EA
2	SF15125-7221-KP	4	NP10007	NA10009	HINGE AND BARREL COVER ASSY 25:1	1	EA
3	NP10007	1	NC10060		HINGE ARM	4	EA
3	NP10007	3	NC10053		HINGE/COVER ROD	1	EA
3	NP10007	5	NC10061		MODIFIED COLLAR	2	EA
4	NC10061	1	2711-168H		STD COLLAR 16 MM BORE STAINLESS STEEL C/W	2	EA
3	NP10007	7	NC10055		LATCH-BARREL - MP24PC CR100	1	EA
3	NP10007	9	NC10129		LATCH LEVER BRACKET	1	EA
3	NP10007	10	NC10089		SPACER	1	EA
3	NP10007	11	NC10130		LATCH LEVER	1	EA
3	NP10007	12	NC10059		COVER BRACKET	2	EA
3	NP10007	13	NC10054		BARREL COVER 25:1	1	EA
3	NP10007	14	2323-6040B		HANDLE.AISA 304 STAINLESS STEEL MATT FINISH	1	EA
3	NP10007	16	NC10127		COVER STOP	1	EA
2	SF15125-7221-KP	5	SP12794	SA11883	MACHINE PIPING ASSY MP24 25:1 NO CHILL ROLL	1	EA
3	SP12794	1	NC10026		MANIFOLD MP24PC 25:1#MP24PC INTEGRA -	1	EA
4	NC10026	7	2427-6125A		STAINLESS STEEL 316 MATL. STRAIGHT UNION.	2	EA

3	SP12794	5	2475-206		GATE VALVE, BRONZE TO BS5154 STRAIGHT 'F'	2	EA
3	SP12794	6	NC10126		PIPING GUARD	1	EA
3	SP12794	17	2426-5905H		PRESSURE PLUG 1/8-27 NPTF LEVEL SEAL	1	EA
3	SP12794	20	2452-6190K		ADAPTOR 1/8'BSPT x 1/4'BSP	20	EA
3	SP12794	21	2427-6131F		HEXAGON NIPPLE ST.ST.316 1/4 BSP WITH	14	EA
3	SP12794	22	2452-6098J		DESIGNATION FITTING 710-04-04#	4	EA
3	SP12794	24	E32-284-84		HOSE ASSEMBLY TO DRG 32-284-84	10	EA
3	SP12794	25	E32-284-72		HOSE ASSEMBLY TO DRG 32-284-72	5	EA
3	SP12794	26	2476-6467K		1/4" BSPT M/M CHECK VALVE (BALL TYPE)	4	EA
3	SP12794	30	NC10097		BRACKET - MP24 INTEGRA	2	EA
3	SP12794	33	2427-693G		STRAIGHT UNION M/F ST ST 316 1/2"BSP	2	EA
3	SP12794	34	2475-204		GATE VALVE, BRONZE TO BS5154 STRAIGHT F,	2	EA
3	SP12794	36	2468-034G		HOSE ADAPTOR ST.ST.316 MALE 3/4 INS BSPT	4	EA
3	SP12794	37	1827-336E		REINFORCED FOOD QUALITY PVC HOSE 19 ID PART	2	M
3	SP12794	38	2468-886L		HOSE CLIP BS5315 REF 30 22MM TO 30MM	4	EA
3	SP12794	48	NC10486		COOLING UNIT MOUNT PLATE - MP24 INTEGRA	1	EA
2	SF15125-7221-KP	6	SP12790		AGITATOR ASSEMBLY MP24PC 25:1 440C	2	EA
3	SP12790	1	203-224N-25TC		AGITATOR SHAFT ASSEMBLY MP24 25:1	2	EA
3	SP12790	2	263-224N-1		TWIN FEEDSCREW FOR.1.00D LEAD/L=1.50 440C	8	EA
3	SP12790	3	262-224N-1		TWIN FEEDSCREW FOR.1.00D LEAD/L=1.00 440C	6	EA
					SET AT 60 DEGREES FORWARDING		
3	SP12790	4	289-224N-1		PADDLE D/4 440C	10	EA

3	SP12790	5	263-224N-1		TWIN FEEDSCREW FOR.1.00D LEAD/L=1.50 440C	4	EA
					SET AT 60 DEGREES FORWARDING		
3	SP12790	6	289-224N-1		PADDLE D/4 440C	6	EA
					SET AT 30 DEGREES REVERSING		
3	SP12790	7	289-224N-1		PADDLE D/4 440C	8	EA
3	SP12790	8	262-224N-1		TWIN FEEDSCREW FOR.1.00D LEAD/L=1.00 440C	4	EA
					SET AT 60 DEGREES FORWARDING		
3	SP12790	9	289-224N-1		PADDLE D/4 440C	6	EA
					SET AT 30 DEGREES REVERSING		
3	SP12790	10	289-224N-1		PADDLE D/4 440C	8	EA
3	SP12790	11	262-224N-1		TWIN FEEDSCREW FOR.1.00D LEAD/L=1.00 440C	4	EA
					SET AT 30 DEGREES REVERSING		
3	SP12790	12	289-224N-1		PADDLE D/4 440C	8	EA
					SET AT 30 DEGREES REVERSING		
3	SP12790	13	289-224N-1		PADDLE D/4 440C	6	EA
					SET AT 30 DEGREES REVERSING		
3	SP12790	14	263-224N-1		TWIN FEEDSCREW FOR.1.00D LEAD/L=1.50 440C	2	EA
3	SP12790	15	351-224N-1		TWIN DISCH SCREW 1.00D LEAD/L=23mm 440C	2	EA
3	SP12790	17	435-224N		SCREW TIP	2	EA
2	SF15125-7221-KP	7	SP12974	SA12026	CLEANING CHUTE ASSEMBLY	1	EA
3	SP12974	1	3X441-224N		CLEANING CHUTE	1	EA
3	SP12974	5	SC17253		SWITCH BRACKET	1	EA

3	SP12974	15	8192-6629H		REPLACEMENT MAGNETIC ACTUATOR FOR	1	EA
2	SF15125-7221-KP	8	SP12817	SA11899	PAINT AND LABELLING DETAILS MPF24	1	EA
3	SP12817	2	SM10542		BAKER PERKINS LOGO - MPF 24	2	EA
3	SP12817	3	2329-6030B		SELF ADHESIVE LABEL, SIMILAR TO SETON REF	2	EA
3	SP12817	6	2539-6004C		LABEL-SELF ADHESIVE ARROW	4	EA
3	SP12817	10	NM10028		WARNING LABEL (UK) SHARP ROTATING PARTS	1	EA
2	SF15125-7221-KP	9	SP14441		Additional Elements for Co-Extrusion	1	EA
3	SP14441	1	494-224N-1		SINGLE LEAD FS LH - 0.5D X 0.25HX MP24PC	2	EA
3	SP14441	2	482-224N-1		SINGLE LEAD FS LH 1D X 0.25HX	2	EA
2	SF15125-7221-KP	10	SP14444	SA13503	Key Parts - MPF24 (25:1)	1	EA
3	SP14444	1	9387628H		NUMBERPLATE (ENGLISH) CE	1	EA
3	SP14444	2	NM10013		TOOLKIT FOR MP24PC CR100	1	EA
					DIE IN POSITION BRACKET		
3	SP14444	6	SC17255		SWITCH BRACKET	1	EA
3	SP14444	20	2476-6598F		Burst Plug 1/2 -20 UNF. 304 St.St. Burst pr	1	EA
3	SP14444	31	5X735-184		THERMOCOUPLE FIXING PLATE	2	EA
3	SP14444	35	17X1034-084N		INJECTOR LOCKING SCREW	2	EA
3	SP14444	36	35X1035-084N		LIQUID INJECTOR TUBE	2	EA
3	SP14444	37	2452-6077F		8MM DIA.X 1/4"BSP ST.ST FEMALE STUD COUPLING	2	EA
3	SP14444	38	2452-6076H		ST.ST.BUSH 1/4" X 1/8" PART NO.SB2-SS	2	EA
3	SP14444	39	2452-6078D		PUSH ON ELBOW 1/8"BSPT PART NO.C5-4/2.7-1/8"	2	EA
3	SP14444	41	2427-6227D		ADAPTOR ST ST 1" NPT FEM X 1" BSPT MALE O	2	EA

3	SP14444	42	2427-6253C		Adaptor St.St. 1/2" NPT Female x 1/2" BSPT M	2	EA
3	SP14444	43	2427-6254A		Adaptor St.St. 1/4" NPT Female x 1/4" BSPT M	2	EA
3	SP14444	46	SM10895		WARNING LABEL - MP24PC	2	EA
2	SF15125-7221-KP	15	SE3065		EPL; MPF24 (25:1) Extruder (Fixed Feeder)	1	EA
					*** MAIN DRIVE AC SERVO MOTOR ***		
3	SE3065	10	8411-6023A		UNIMOTOR FM. 190U2F BRUSHLESS AC SERVO MOTOR	1	EA
3	SE3065	14	8412-6039B		POWER AND SIGNAL CABLES WITH CONNECTORS FOR	1	EA
					*** BARREL HEATING *** (INCLUDES 2 SPARE)		
3	SE3065	50	NK2087		CARTRIDGE HEATER. 220/240V 150W.	34	EA
					*** BARREL COOLING ***		
3	SE3065	60	8225-6588C		1/4" SOLENOID VALVE. NORMALLY CLOSED. DIRECT	4	EA
					*** BARREL CONTROL THERMOCOUPLES ***		
3	SE3065	70	SK2212		TEMPERATURE PROBE - TYPE 'K' THERMOCOUPLE	4	EA
					*** FEED FUNNEL SWITCH ***		
3	SE3065	100	8192-6530E		MAGNETIC SAFETY SWITCH FRS 21-GD2 DC. 24V.	1	EA
					*** BARREL OPEN HINGE SWITCH ***		
3	SE3065	120	8192-6475J		ENSIGN 3 COMPACT SAFETY INTERLOCK SWITCH.	1	EA
					*** DIE PRESSURE TRANSDUCER ***		
3	SE3065	200	8262-5066F		PRESSURE TRANSDUCER MODEL 2075-D9-3M RANGE	1	EA
3	SE3065	204	8262-6264H		PRESSURE TRANSDUCER CONNECTION LEAD.	1	EA
					*** DIE IN POSITION SWITCH ***		

3	SE3065	210	8192-6530E		MAGNETIC SAFETY SWITCH FRS 21-GD2 DC. 24V.	1	EA
					*** ADDITIONAL ACTUATOR FOR SECOND DIE ***		
3	SE3065	214	8192-6629H		REPLACEMENT MAGNETIC ACTUATOR FOR	1	EA
					*** CLEANING CHUTE MAGNET ***		
3	SE3065	230	8192-6629H		REPLACEMENT MAGNETIC ACTUATOR FOR	1	EA
2	SF15125-7221-KP	20	SE3069		S/O Conduit - MPF24 (25:1) Extruder	1	EA
					*** CONTROL THERMOCOUPLE ASSEMBLY ***		
3	SE3069	10	2517-6146J		CABLE COMPRESSION GLAND. TYPE SKINTOP ST.	4	EA
3	SE3069	14	2517-6061F		CABLE GLAND LOCKNUT M20 THREAD.	4	EA
					*** CARTRIDGE HEATER ASSEMBLY ***		
3	SE3069	30	2517-6146J		CABLE COMPRESSION GLAND. TYPE SKINTOP ST.	32	EA
3	SE3069	34	2517-6061F		CABLE GLAND LOCKNUT M20 THREAD.	32	EA
3	SE3069	38	2527-6032F		STOPPING PLUG . BLACK PLASTIC . EEXE M16.	6	EA
3	SE3069	40	2816-199		CIRCLIP EXT TYPE 1400 1/4	70	EA
					*** CONTROL STATION SUPPORT ARM - NON STANDARD LENGTH ***		
3	SE3069	50	2529-6531J		CP60 Support Section 1000mm Part Number:	1	EA
3	SE3069	58	2529-6526B		Wall Mounting Hinge for CP60 Support Arm Sys	1	EA
3	SE3069	60	2529-6527L		Angle Coupling for CP60 Support Arm System.	1	EA

					* REAR THROUGH BOX - FOR CONTROL STATION FEEDER WIRING AND SERVO MOTOR LEADS * BOX TO BE MOUNTED HORIZONTALLY OVER HOLE IN REAR. BOX SECTION & GLANDED INTO REAR OF PANEL. SEAL MATING SURFACES WITH CLEAR SILICON MASTIC		
3	SE3069	70	2521-7815E		TERMINAL BOX WITH PLAIN LID 280X220X85	1	EA
3	SE3069	80	2524-285H		LOCKRING ST ST 304L 32mm (CONDUIT O/D)	3	EA
3	SE3069	98	8796-6168D		STP CAT5E PATCH CABLE, 3 METERS LONG. GREY	1	EA
3	SE3069	100	2532-238K		TRI-RATED CABLE, SINGLE CORE 4.0mm2 GREEN	5	M
					*** MAIN DRIVE SERVO ASSEMBLY ***		
3	SE3069	110	2517-6085C		CABLE COMPRESSION GLAND. TYPE SKINTOP ST.	1	EA
3	SE3069	114	2517-6014D		LOCKNUT PG21 GREY NYLON HEYCO COLOUR GREY	1	EA
3	SE3069	115	2517-6146J		CABLE COMPRESSION GLAND. TYPE SKINTOP ST.	1	EA
3	SE3069	116	2517-6061F		CABLE GLAND LOCKNUT M20 THREAD.	1	EA
					*** FEEDER ASSEMBLY ***		
3	SE3069	170	2521-888D		TERMINAL BOX IP66 160X 100 X 50 TCE2-S304	1	EA
3	SE3069	173	2515-6451E		FEED THROUGH TERMINAL 1492-J3. GREY 2.5 MM2	12	EA
3	SE3069	174	2515-6447G		EARTH TERMINAL GREEN/YELLOW.	2	EA
3	SE3069	175	2515-6460D		MARKER TAG FOR 1492-J3 TERMINALS	12	EA
					*** DIE PRESSURE ASSEMBLY ***		
3	SE3069	400	2517-6146J		CABLE COMPRESSION GLAND. TYPE SKINTOP ST.	1	EA
3	SE3069	412	2517-6061F		CABLE GLAND LOCKNUT M20 THREAD.	1	EA
2	SF15125-7221-KP	25	SE3078		Intouch Runtime License	1	EA

3	SE3078	10	8794-7269E		InTouch 2014R2 Runtime 3K Tag with I/O.	1	EA
1	SF15125-2491-KA	4	SF15125-7221A1-KP	SA13514	26.4 Key Plan - Single Stream Co-Extrusion Die	1	EA
2	SF15125-7221A1-KP	1	SP14440	SA13514	Co-Extrusion Die Assembly	1	EA
3	SP14440	1	SC17429		TRANSITION PLATE - MPF24	1	EA
3	SP14440	2	SC23074		DIE HOLDER -	1	EA
3	SP14440	3	SC17430		RETAINING DISC	1	EA
3	SP14440	4	SC23075		DIE OUTER (5.4MM BORE)	1	EA
3	SP14440	5	SC23076		CENTRE TUBE (3 I/D X 4 O/D)	1	EA
3	SP14440	6	SC21560		BAFFLE RING	1	EA
3	SP14440	7	SC20897		INJECTOR - CO-EXTRUSION	1	EA
3	SP14440	8	6486098D		CONNECTOR - EXTRUDER	1	EA
3	SP14440	9	SC17253		SWITCH BRACKET	1	EA
3	SP14440	10	2476-6598F		Burst Plug 1/2 -20 UNF. 304 St.St. Burst pr	1	EA
3	SP14440	11	2415-6069D		O' RING BS4518. 0275-30. VITON 33.5 O/D	4	EA
3	SP14440	12	SC22649		DIE OUTER 9 DIA BORE	1	EA
3	SP14440	13	SC22209		CENTRE TUBE - 6.5 NOZZLE - 5.0 BORE	1	EA
3	SP14440	14	SC22014		NYLON DRIFT	1	EA
3	SP14440	20	2622-6104B		HEADLESS DRILL JIG BUSH REF.WPP15E10 WIXROYD	2	EA
1	SF15125-2491-KA	5	SF15125-7221A2-KP	SA11882	26.5 Key Plan - Assembly Retractable Cutter	1	EA
2	SF15125-7221A2-KP	1	SP12816	SA11882	S.A RETRACTABLE CUTTER MPF24	1	EA

3	SP12816	1	SC17177		CUTTER BOX PLATES	1	EA
3	SP12816	2	SC17181		SIDE COVER -	1	EA
3	SP12816	3	SC17215		HINGED GUARD	1	EA
3	SP12816	4	SC17180		LOWER COVER	1	EA
3	SP12816	5	SC17179		CUTTER BOX STRETCHER	5	EA
3	SP12816	6	SC17214		STRETCHER - CUTTER BOX	1	EA
3	SP12816	12	SC17219		RETAINED HANDLE	1	EA
4	SC17219	2	2821-6412D		ELESA LOBE KNOB. STAINLESS STEEL 40DIA M8	1	EA
3	SP12816	15	SC17237		EYE SCREW MOUNTING BLOCK	1	EA
3	SP12816	17	2781-342J		SWING BOLT SS M8x50LG REF.810-208-50 - WDS	1	EA
3	SP12816	18	2821-6412D		ELESA LOBE KNOB. STAINLESS STEEL 40DIA M8	1	EA
3	SP12816	24	SC17166		HINGE BLOCK	1	EA
3	SP12816	25	2621-6201K		FLANGED BEARING GFM 2023-21 IGUS	1	EA
3	SP12816	29	SC17230		SWITCH MOUNTING PLATE	1	EA
3	SP12816	30	SC17229		HINGE SAFETY CAM	1	EA
3	SP12816	31	2621-6201K		FLANGED BEARING GFM 2023-21 IGUS	1	EA
3	SP12816	36	SC17240		LOCK BRACKET	1	EA
3	SP12816	40	SC17216		SAFETY CAM	1	EA
3	SP12816	45	SC17186		MOTOR MOUNTING BRACKET	1	EA
3	SP12816	47	SC17195		SPACER	4	EA
3	SP12816	54	SM10536		PAIR OF LINEAR GUIDES TO DRYLIN W PART No,	1	EA
3	SP12816	55	2676-6093K		DRYLINW-W HOUSING BEARING. WJUM-01-20-ES	4	EA

3	SP12816	57	SC17193		LOCKING CLAMP	1	EA
3	SP12816	58	SC17220		CLAMPING HANDLE	1	EA
4	SC17220	2	2821-6412D		ELESA LOBE KNOB. STAINLESS STEEL 40DIA M8	1	EA
3	SP12816	72	SC17247		BEARING BLOCK -	1	EA
3	SP12816	73	SC17235		SHIM	1	EA
3	SP12816	76	SC17242		ADJUSTMENT BLOCK	1	EA
3	SP12816	77	SC17234		SHIM	1	EA
3	SP12816	81	SC17236		ADJUSTMENT SPINDLE	1	EA
3	SP12816	82	2621-323A		METRIC BORB PLN 16 X 22 X 16	2	EA
3	SP12816	86	SC17191		MOTOR PLATE	1	EA
3	SP12816	90	SC17231		MOTOR SHIM	2	EA
3	SP12816	98	SC17194		CUTTER ADAPTOR	1	EA
3	SP12816	102	SC17199		CUTTER MOUNT	1	EA
3	SP12816	105	491-019		CUTTER KNIFE	1	EA
3	SP12816	108	SC17196		INNER GUARD	1	EA
3	SP12816	112	SC17224		OUTER GUARD	1	EA
2	SF15125-7221A2-KP	5	SE3066		EPL; Product Cutter Assembly	1	EA
					*** CUTTER MOTOR ***		
3	SE3066	10	8401-7151E		0.55kW /0.63kW MOTOR. TEFC, 4 Pole, IP55. M	1	EA
					*** CUTTER IN POSITION SWITCH ***		
3	SE3066	20	8191-6092J		GUARDMASTER CENTURION TIME DELAY BOLT SWITCH	1	EA

					*** CUTTER ACCESS GUARD SWITCH ***		
3	SE3066	30	8191-6092J		GUARDMASTER CENTURION TIME DELAY BOLT SWITCH	1	EA
2	SF15125-7221A2-KP	10	SE3046		S/O Conduit - Product Cutter Assembly	1	EA
					*** MOTOR & ACCESS GUARD SWITCH *** REF 22 * THROUGH BOX - MOUNT AT REAR OF CUTTER BELOW CUTTER MOTOR *		
3	SE3046	24	2521-923F		TERMINAL ENCLOSURE ST ST TCE1-S304	1	EA
3	SE3046	70	2526-094E		ADAPTAFLEX. LOCKNUT. M32. LIST NO. LNB/M32.	1	EA
1	SF15125-2491-KA	6	SF15125-7221A3-KP	SA13513	26.6 Key Plan - Die Assembly	1	EA
2	SF15125-7221A3-KP	1	SP14439	SA13513	Die Assembly	1	EA
3	SP14439	1	5X441-224N		TRANSITI0N PLATE MPF24 - 36mm LONG DIE INSER	1	EA
3	SP14439	3	2622-6104B		HEADLESS DRILL JIG BUSH REF.WPP15E10 WIXROYD	2	EA
3	SP14439	5	SC17732		DIE INSERT - FLEX BLADE INSERTS	1	EA
3	SP14439	7	SC14910		LOOP DIE INSERT	1	EA
3	SP14439	8	SC15522		DIE INSERT 2.8mm ROUND	1	EA
3	SP14439	9	SC23070		DIE INSERT SPACER - 17mm -	1	EA
3	SP14439	10	SC23072		DIE INSERT SPACER - 9mm -	1	EA
3	SP14439	11	SC17253		SWITCH BRACKET	1	EA
3	SP14439	12	2476-6598F		Burst Plug 1/2 -20 UNF. 304 St.St. Burst pr	1	EA
1	SF15125-2491-KA	7	SF15125-7831-KP		26.7 Key Plan Barrel Cooling Unit MPF24	1	EA
2	SF15125-7831-KP	1	NK2217		I-temp ci 90T9 Cooling Unit, with increase	1	EA

1	SF15125-7221-KP	30	SF15125-7221P1-KP		26.8 Key Plan MPF24 Extruder Control Panel	1	EA
2	SF15125-7221P1-KP	10	SK2610	SD2321	MPF24 (25:1) Extruder Panel Bill of Materials	1	EA
2	SF15125-7221P1-KP	20	PM11464		COMPANY LOGO (350 X 80)	1	EA

27 Index of Other Makers Leaflets

Note Additional OML's and Manuals are supplied with the Control Panel.

Manufacturer	Equipment
Allen Bradley	Panelview Plus HMI PowerFlex 70 Drive
Alpha (fitted to extruder Unimotor)	Gear Head Quick Guide Gear Head Manual
Asco	SCE Solenoid Valve
Control Techniques (extruder drive motor)	Unimotor 190 Unidrive M700 Drive
Crane	Bronze Gate Valve
Cross & Morse	Chain Coupling
Cynergy	SSF212 Level Switch
Dynisco	Burst Plug
Guardmaster	Centurion Safety Switch Ensign Safety Switch Ferrogard Safety Switch
Hygate (David Brown)	Splitter Gearbox
Schenck Feeder	Not Baker Perkins supply
Siemens (cutter drive)	1LE1001 Motor
Terwin	2000 Series Pressure Transducer
Timken	Roller Bearings
Tricool (ICS)	Barrel Cooling Unit
Vapor-Tek	Rust Preventative Treatment
Watlow	Cartridge Heater Watlube Datasheet
Marlow	530 Pump

28 FAXBACK Form

Fax to: Baker Perkins

Fax no: +44 (0)1733 283001

FAO: Technical Support Centre

NOTE: *During the first month of the warranty* - if the equipment IS NOT being commissioned by Baker Perkins, this form must be completed and returned to us, Thank you.

Contract no:

- SF15125

Type:

- MPF24 Extruder & Control System

Startup date:

- .....

We confirm that we are in receipt of the operating manual for the above machine.

Company using machine:

.....

.....

.....

.....

.....

Signed for and behalf of the above company:

Signed.....

Date.....

Comments, spare parts requirements, training requirements:

29 Customer Feedback

Fax +44 (0)1733 283001

FAO: Chris Goodacre

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Take the time to make a photocopy of this form so that you will have the original form for future feedback use.

Please review the manual, or any previous manuals, then complete this form. Please fax this form to Baker Perkins.

Thank you

Any additional comments.....

PTO -

TECHNICAL PUBLICATION QUALITY SURVEY
CUSTOMER FEEDBACK

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Fax the completed form to:

Chris Goodacre, Technical Publications, +44 (0)1733 238001

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30 Conversion Table

Unit	To Convert	Multiply
Length	millimetres to inches	0.03937
	inches to millimetres	25.4
	metres to feet	3.2808
	metres to yards	1.0936
	metres to fathoms	0.5468
	feet to metres	0.3048
	yards to metres	0.9144
	fathoms to metres	1.8288
	kilometres to miles	0.62137
	miles to kilometres	1.60934
Area	hectares to acres	2.4711
	acres to hectares	0.404686
	sq kilometres to acres	247.105
	sq kilometres to sq miles	0.3861
	acres to sq kilometres	0.004047
Weight	grams to ounces	0.03527
	ounces to grams	28.3495
	kilograms to pounds	2.20462
	pounds to kilograms	0.4536
Speed	kilometres/hour to miles/hour	0.62137
	miles/hour to kilometres/hour	1.6093
	miles/hour to knots	0.8684
Energy	kilometres/litre to miles/gallon	2.82481
	miles/gallon to kilometres/litre	0.35401
Temperature	° Celsius to ° Fahrenheit	multiply by 9/5, and add 32
	° Fahrenheit to ° Celsius	subtract 32, and multiply by 5/9
Pressure	lb/in^2 to bar	0.06895
	bar to lb/in^2	14.5


Baker Perkins