



UNITED PLASTICS GROUP INC

MUGGLE PALLET TRANSFER TRACK

CPR REFERENCE: J17911 – W/O 1323

Prepared by: D W Griffiths

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Supplier: CPR Automation Ltd

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1. GENERAL INFORMATION

1.1 Introduction

The machine has been designed and manufactured to assemble the muggle assemble. The track system to undertake this consists of four stations manual and automatic.

| | | |
|-----------|-----------|--|
| Station 1 | Manual | Fit 4 bezels Fit 4 button assemblies Fit 2 shields |
| Station 2 | Manual | Fit 2 shields Fit 4 light pipes |
| Station 3 | Automatic | Heat stake assembly |
| Station 4 | Automatic | Pick and place from pallet |

1.2 Detailed System Description

The track is a belt driven track generally in a rectangular shape. Transferred on the belts are 8 off pallets each with 4 location fixtures. The pallets are transferred to each station where they are managed by cylinders and sensors.

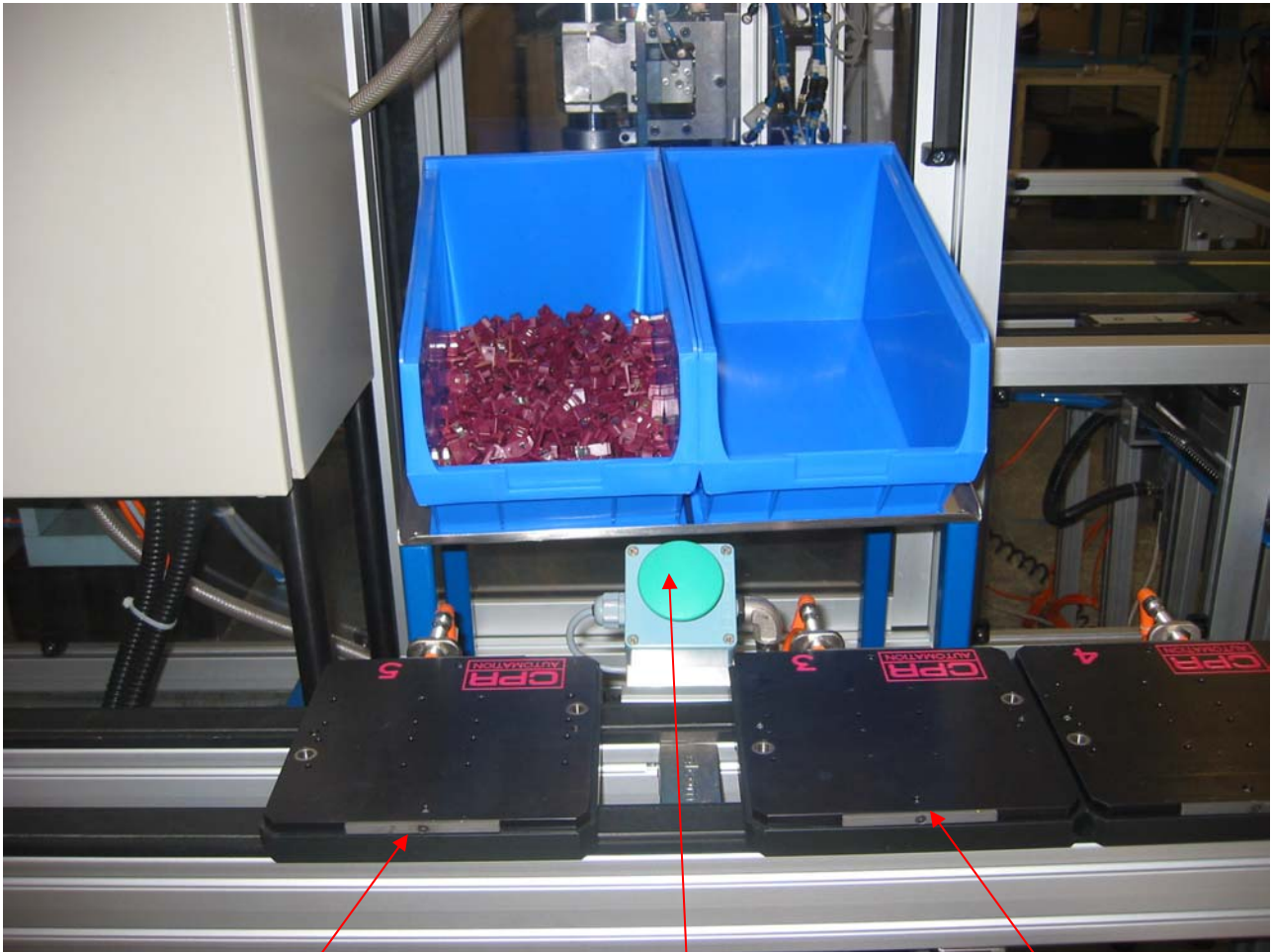
At station 1 the pallet is driven from the buffer site into the station. Here the operator undertakes the manual loading of the pallet with the component parts. After manual loading the operator presses the station complete push button or the foot pedal and the pallet is released.

A second operator at station 2 loads the pallet fixture with more components and upon completing this task releases the pallet via a push button or the foot pedal.

With all of the parts having been loaded to the pallet the transfer track moves the pallet to station 3. At station 3 the pallet is lifted via a heavy duty lift unit into position prior to the free issue Toman heat staking unit being operated. After the pallet has been sited correctly the PLC outputs a go signal to the Toman and this unit advances and heat stakes the components to form an assembly. Having correctly achieved this the Toman retracts and the pallet is released from the station.

Station 1

Manual Load



Station

End of assembly button

Buffer

Station 2

Manual Load

Pallet at station proximity sensor

End of assembly button

Pallet at buffer stop proximity sensor



Station stop

Buffer stop

Station 3

Toman heat staking unit

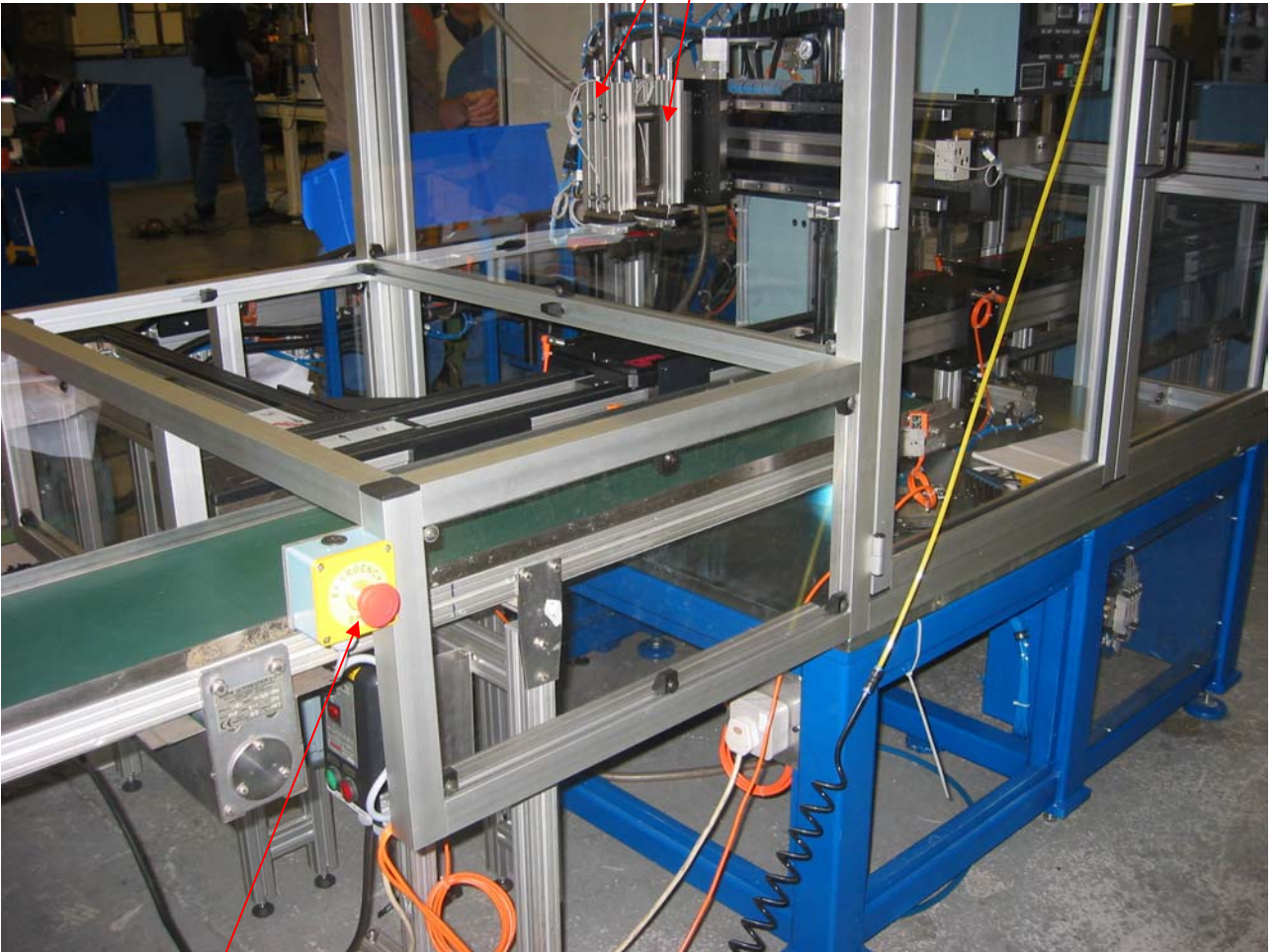


Heavy duty lift system

Station 4

Pick and Place

Independent vertical cylinders with gripper



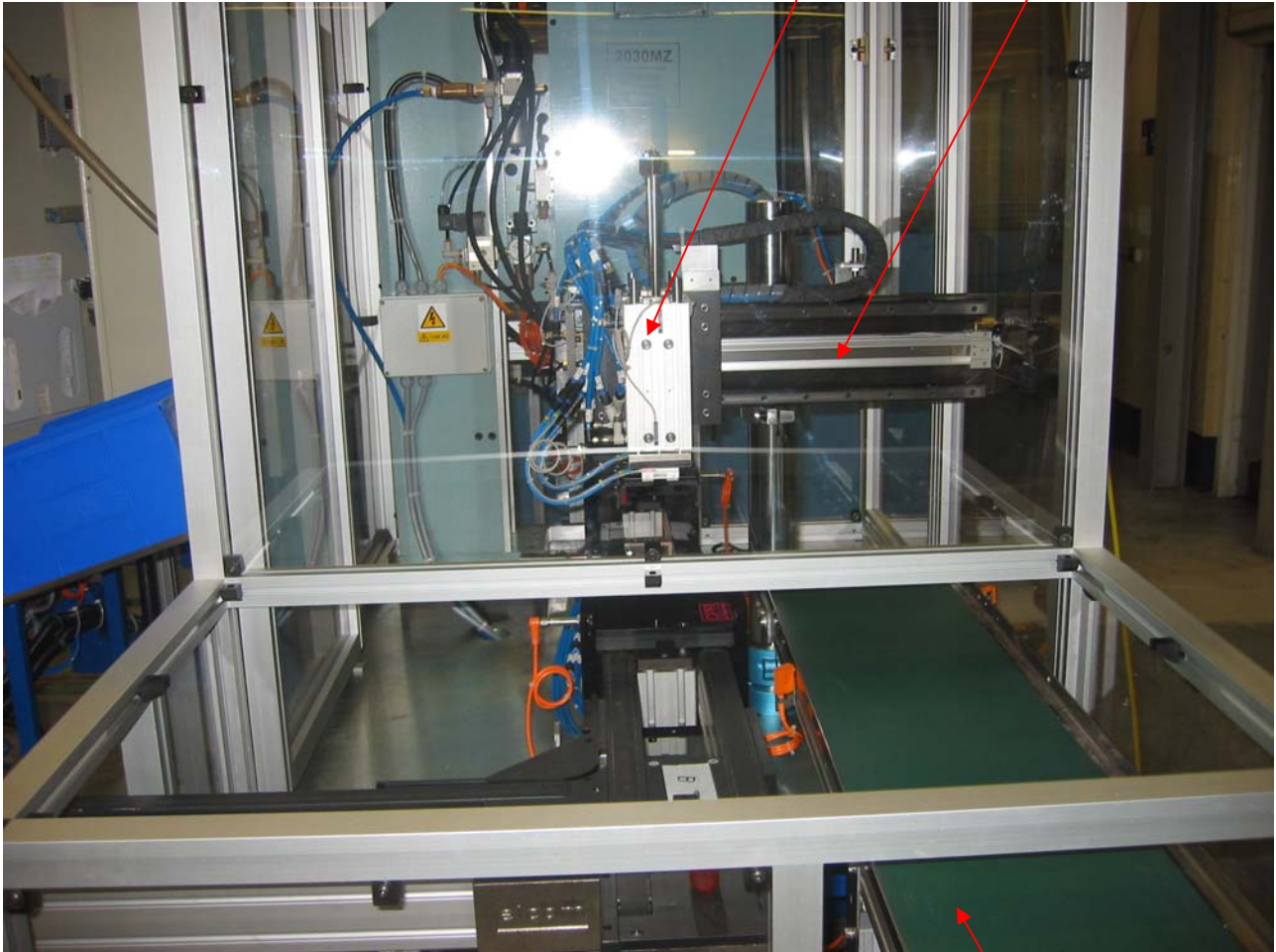
Emergency stop

Station 4

Pick and Place

Vertical actuation

Horizontal actuation



Output conveyor

Station 4 consists of a pallet location system and a pick and place unit. The pallet with the 4 heat staked assemblies is located and the 4 products removed. These products are placed onto an output conveyor. After this the pallet is once again released from the station and returns empty to station 1 where the track cycle begins again.

1.3 Overall Dimensions and Mass

| | | |
|---|---|------------|
| Height including electric panel approx: | = | 2.2 metres |
| Width including output conveyor: | = | 1.76m |
| Length excluding output conveyor: | = | 6.78m |
| Mass est excluding output conveyor: | = | 3 tonnes |

1.4 Operating Conditions

The machine has been designed for normal shopfloor conditions as seen at UPG, Mountain Ash, South Wales.

Operating temperature - 10°C - +30°C

1.5 Environmental Conditions

In normal operating conditions the machine does not emit any substances considered harmful to the environment.

Ensure at all times that best working practices are observed. Please ensure that good industrial hygiene and safety practices are undertaken.

Noise emissions: - Within health and safety requirements at 70 db (A).

1.6 Power Requirements

Power: 230V single phase.
Control voltage: 24V DC.
Pneumatics: 5.5 bar dry air.

1.7 Potential Safety Hazards

When operating and maintaining the machine follow the procedures laid down in this manual.

Ensure that all guards are correctly sited at all times and that no safety devices are disabled.

Disconnect the electrical supply prior to starting any repair or maintenance.

Disconnect the pneumatic supply prior to starting any repair or maintenance.

Ensure that all personnel undertake full training prior to using the machine.

In accessing the guard around station 3 and 4 the heat staking tool is HOT!! Ensure that protective clothing is used.

1.8 Details of Machine Builders

CPR Automation Limited
Apollo
Lichfield Road Industrial Estate
Tamworth
Staffordshire
B79 7TN

Tel 01827 57475
Fax 01827 62354

Contact: Service Department

1.9 CE Certificate

DECLARATION OF CONFORMITY

CPR Automation

7 Apollo
Lichfield Road Industrial estate
Tamworth
Staffordshire
b79 7tn
United Kingdom

Description of Product

Muggle Track

Name, Type or Model, Batch or Serial Number

J17911 w/o 1323

Standards

BS EN 292 Basic Principles of Design 1993
PR EN 954-1 Safety of Machinery 1993 - Principles for the Design of fail-safe Control Systems
BS EN 953 Guarding (Design and Construction) 1993

iso 9000

Place of Issue

Tamworth

Name of Authorised Representative

D Griffiths

Position of Authorised Representative

Technical Director

Declaration: I declare that as the authorised representative, the above information in relation to the supply/manufacture of this product, is in conformity with the stated standards and other related documents following the provisions of (89/392/EEC) Directives

Signature of Authorised Representative



Date DEC 2007

2.0 TECHNICAL INFORMATION

2.1 Introduction

The machine has been designed and manufactured to assemble the muggle assembly via heat staking. The machine utilises 8 off pallets to transfer the components from station to station.

2.2 Control System

The machine is controlled via a Mitsubishi PLC and touch screen. The PLC is mounted in the main electrical cabinet and the screen is sited on the main electrical cabinet face. This is sited on the base of station 3 and 4 facing the operators.

Within the electrical cabinet there are various components which can be categorised into the following elements of the control system.

- Mains distribution
- Safety
- Control

The equipment and their function are outlined below.

Mains Distribution

Load Break Switch/Isolator

The load break switch is a mechanical device capable of making, maintaining and breaking the normal running current of the machines as well as overload current levels. The isolator is operated from the mechanical rotary actuator mounted on the door to the enclosure and will totally isolate the machine from the incoming mains supply. As a safety interlock the isolator is fitted with a padlockable handle to enable the machine to be 'locked off' and render the machine safe for maintenance work etc.

Mains Contactor (C.M.)

The mains contactor is a mechanical switching device controlled by an electromagnet capable of making and breaking the mains currents involved in the system. The mains contact provides the operator with a simple on/off control of the high voltage equipment. The mains contact can only be energised after the safety circuit has been primed and reset. Please note: the mains contact **does not** remove the power from all of the equipment placed in the system, only the items considered to be dangerous during the risk assessment.

Thermo-Magnetic Miniature Circuit Breakers (MCB)

Positioned 'in line' with all equipment on the machine the MCB provides overload protection to each individual device and allows the devices to be further isolated in the event of maintenance. The type used on the machine, having a breaking capacity and are of type D to allow for the high in-rush currents upon start up of some of the equipment incorporated. Each MCB is single pole in design and individually rated for the item of equipment it is employed to protect.

Motor Protective Circuit Breaker (MPCB)

Each motor on the machine is individually overloaded protected by a MPCB.

Safety Relay

The safety relay is a category 3 device capable of monitoring the various emergency stop buttons and controls incorporated in the system for a change of stage. The safety contacts within the device are positively guided, rated for the task and supply the low voltage power to a number of devices including pneumatic dump valve, main contact and outputs.

The safety device is used in the following modes:-

- Dual Channel Operation
- Manual Reset

The LED's mounted on the device indicate the status of the power supply and the channel. To prime the relay, the orange illuminated reset pushbutton needs to be operated. Upon the relay resetting, the LED's will illuminate. Upon priming the relay, the dump valve is monitored for malfunctions via N/C contacts in the reset circuit, should a fault occur, the relay will not reset.

Control

Power Supply (PWS.1)

The control system within the machine is 24V DC. The power supply for the control system is rated at 5A output. The 24V DC supply is protected by current monitoring devices on both the input and output.

Programmable Logic Control (PLC)

The PLC is the master controller on the machine and controls all of the operations and external equipment. The PC is a Mitsubishi and has indication of the inputs and outputs status. The PLC must be set to "Run" for the machine to function correctly.

System Hierarchy

The PLC is the master controller and controls all the machine operations.

Important Safety Notes

The following safety points must be obeyed at all times while using this equipment.

1. **Always** isolate and lock off the equipment before commencing work on the machine, at more than one point if possible.
2. **Always** electrically test the equipment to ensure the system is empty before commencing work.
3. **Only** qualified personnel with a good knowledge of the equipment should work on the machine control system.
4. **Beware** that the incoming mains supply will remain live after the machine has been isolated and locked off.
5. **Do not** operate the machine with the enclosure doors open or with any safety items removed.
6. **Never** down rate any of the components on the machine.
7. **Never** 'link out' or bypass any part of the machine.
8. **Check** the safety systems on the machine prior to operation to ensure all systems are functional.
9. **Never** disconnect any of the safety equipment on the machine including the earth connection – it is for your own safety.
10. **Always** consult CPR Automation should any uncertainty arise with the equipment on the machine.

Associated Drawings

The following drawings are associated with the machine.

| | | |
|----------------|---|--------------|
| CP1654/00/C/01 | - | Control |
| CP1654/00/C/02 | - | Panel Layout |

Bolt drive conveyor



Motor drive and gear box

MCB's

Beacon stack

Circuit
breakers

Isolator

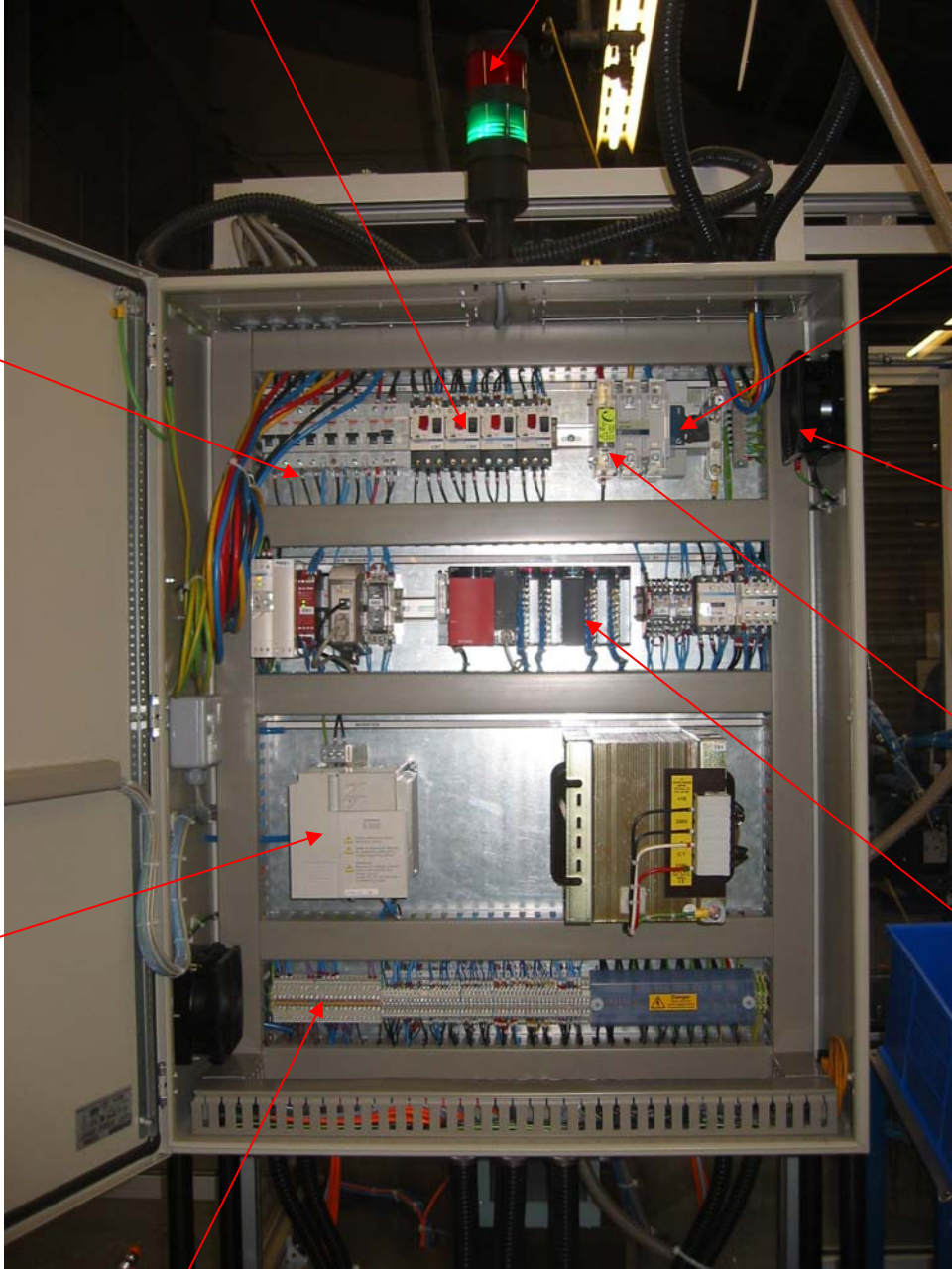
Fan

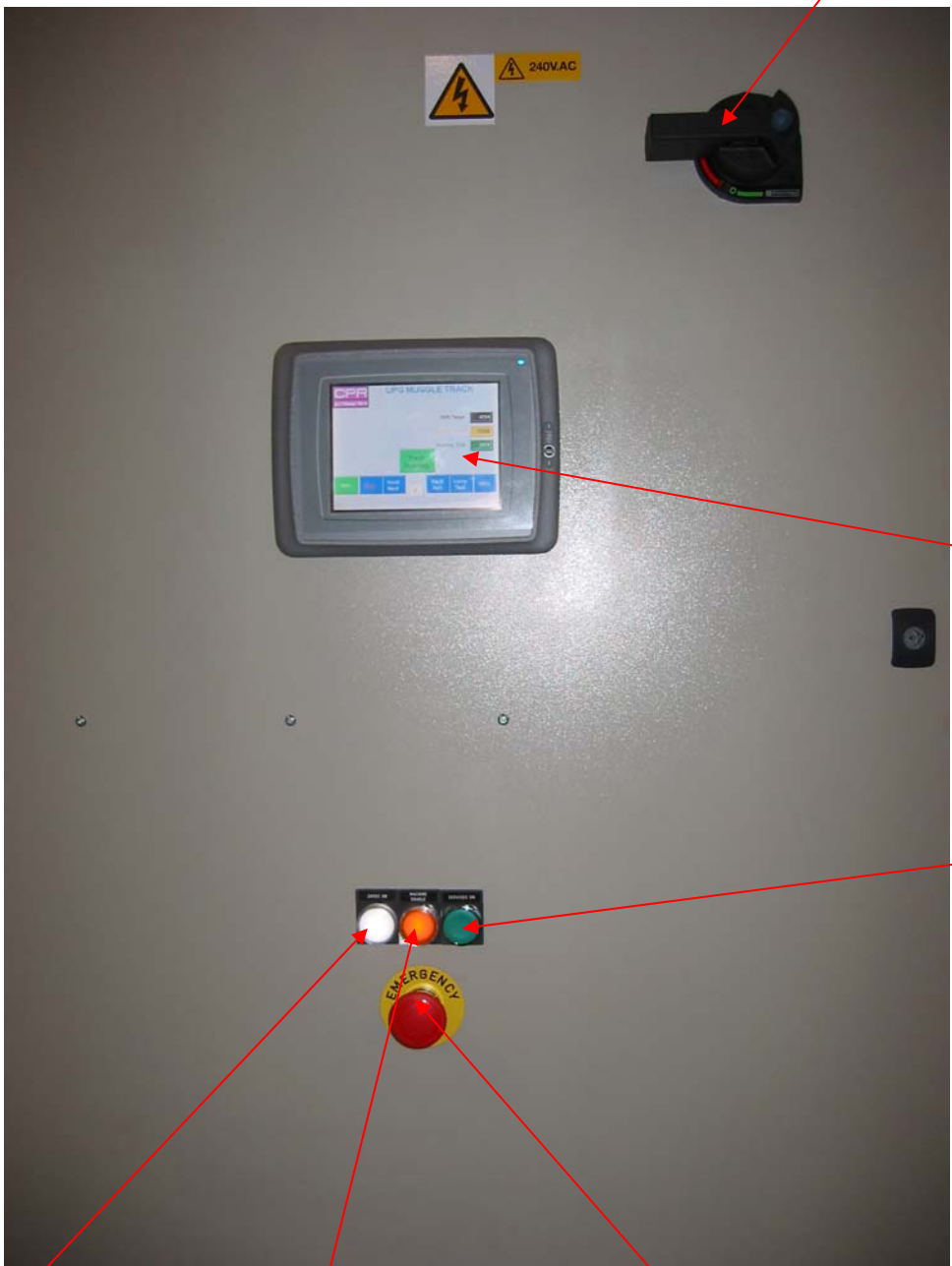
Fuses

PLC

Inverter

Terminals





Mains isolator

HMI
Touchscreen

Services on

24V on

Machine enable

Emergency stop

2.3 Pneumatic System

The pneumatic system designed for the machine is a SMC built system and is made from a number of key components.

1. Shut off valve/isolator.
2. Filter/regulator unit.
3. Pressure regulator.
4. Solenoid valves.

The components and their functions are outlined below.

Shut off Valve/Isolator

The shut off valve, once operated supplies air to the system. The shut off valve houses the port where the main incoming air supply is to be connected with a flexible hose. The shut off valve will isolate the whole machine from the air supply and should be locked off prior to any work commencing on the pneumatic system. The shut off valve is located in the base frame under station 1.

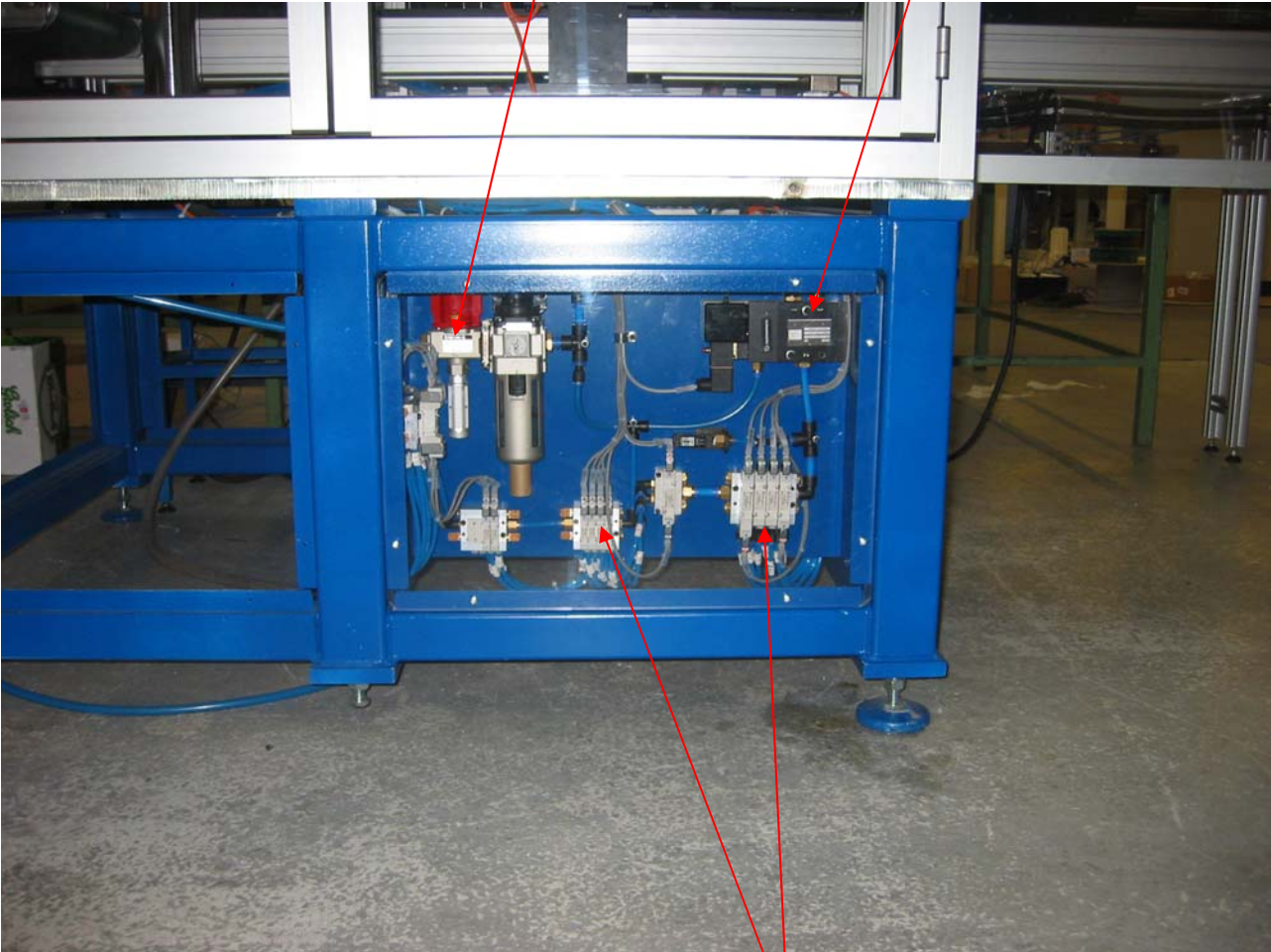
Filter/Regulator Unit

The filter/regulator unit is attached to the shut off valve and allows the user to set the desired machine operating pressure. The machine requires 1.7 bar to operate efficiency. The filter built into the unit will remove any solid particles and moisture droplets from the air supply. Particles larger than 40µm are retained by a sintered filter which should be changed annually for maximum efficiency. Moisture droplets are separated and retained in the water bowl that will drain from time to time to prevent moisture from entering the system. For the filter to work correctly the input pressure must be greater than the output pressure. The filter is an extremely important part of the system, as contaminants in the pneumatic system will accelerate the wear on components and seals etc., adversely affecting the lift of pneumatic components. The filter/regulator unit is located in the base frame under station 1.

Pneumatic panel sited under station 3

Filter/regulator and isolator

Safety dump valve



Valve islands

Monitored Dump Valve

The monitored dump valve is controlled by the control circuit and will only allow the air supply to be applied to the machine once the safety conditions have been satisfied. The monitored dump valve must never be bypassed or removed from the system for safety reasons. The dump valve used in the machine also incorporates a N.C. electrical contact to monitor the stage of the valve, if the contact is not made prior to reset, the system will not start, indicating a fault within the reset circuitry. The monitored dump valve is located in the base frame under station 3.

Pressure Switches

The pressure switch provides an input to the PLC to inform the control system the pneumatic supply is present and correct. The switch should be set to operate at approximately 75 psi. If this input is not present the machine will not run. The pressure switch is located in the baseframe under station 1.

Solenoids

The solenoids are mounted on a series of valve islands and control the cylinder actuation. All solenoids are generally double acting and contain manual overrides for setting purposes. The red LED situated on a valve indicate when the valve is energised.

Important Safety Notes

The following safety points must be obeyed at all times while using this equipment.

1. **Always** isolate and lock off the equipment before commencing work on the machine, at more than one point if possible.
2. **Always** test the equipment to ensure the system is empty before commencing work.
3. **Only** qualified personnel with a good knowledge of the equipment should work on the machine pneumatics system.
4. **Never** by-pass any of the pneumatic components.
5. **Never** work on a pressurised system.
6. **Never** place open pressurised air pipes near the human skin.
7. **Check** the safety systems on the machine prior to operation to ensure all systems are functional.
8. **Never** down rate any of the components on the machine.
9. **Always** consult CPR Automation should any uncertainty arise with the equipment on the machine.

Associated Drawings

The following drawings are associated with the machine.

CP1654/00/P/01 - Pneumatic Circuit

3.0 OPERATING INSTRUCTIONS

At all times the operator should read the instructions displayed on the HMI and follow them to prevent damage to the cell.

There are a variety of hard wired interlocks present in the PLC controller that prevent operation should there be any problems with safety circuits (E/Stops and Guards etc.). In addition there are interlocks which prevent activation of the heat stake operation if the temperature is not correct.

As part of the software design philosophy, wherever possible, the majority of the PLC sensors (proximity, or reed switch) are checked in the "on" and "off" state, at least once during every station cycle. This is true of all cylinder/slide end position sensors, where fitted. This function is not possible with the pallet detection sensors on the track, and there are no sensors associated with track stop movement. With the sensors that can be monitored, if a sensor is not in the correct state, when it is checked during the sequence a diagnostic (fault) message will be generated and the automation may at some point be prevented from completing its operation. The point where the sequence stops, may not instantly be associated with the loss of sensor integrity but often is the one point where the specific status of the sensor (that has been detected as delinquent) can be guaranteed.

The basic operation and control of the heat stake and heaters is provided by the proprietary heat stake equipment supplied with the heat stake mechanics and was sourced by the customer and will not be discussed in this document, including the bulk of the heat stake controls, lamps and switches and buttons.

3.1. Description of Pushbuttons and Indicators

The pushbuttons and lamps for this machine are in three places, in the door to the main electrical panel which also houses the Human Machine Interface (HMI – a touch sensitive colour graphic display), and pallet release push buttons are mounted in switch boxes on the track by the two operator stations.. The buttons by the HMI panel consist of a red mushroom Emergency Stop (E/Stop) button, a white cycle complete lamp, an orange Machine Enable illuminated pushbutton, a white +24V DC lamp and a green Services On pushbutton. A second red mushroom E/Stop button is mounted on the near the off-take (or unload) conveyor by station 4.

Each button or switch will carry out a specific function on the machine, while the indicators will provide feed back on the status of the machine.

3.1.1 Emergency Stop Button

There are two red mushroom emergency stop (E/Stop) buttons, one located on the HMI panel which operate the E/stop circuit and the other is mounted on the near the unload conveyor by station 4. When either red mushroom E/Stop button is pressed, all the air in the system is dumped, and most outputs on the PLC are removed. AC power to the heat stake unit and the inverter drive motor (connected to the track motors) is removed.

The only way to return the machine back to normal operation is to release the appropriate latched E/stop button. This is undertaken by twisting the depressed button clockwise, checking the guards are closed and the E/Stop circuit should then be reset by pressing the illuminated button Machine Enable button. The machine can finally be prepared by pressing the Services On button (see later).

3.1.2 24V DC on Lamp

This white lamp will be illuminated when 24V DC power supply is energised. This lamp is not under PLC control and there is no Lamp Test function available for it.

3.1.3 Illuminated Orange Machine Enable (E/ Stop Reset) Button

When lit this orange button indicates that the safety relay has been energised to its operating condition. When the lamp is extinguished, the safety relay has been dropped out and will be preventing machine movement.

This is extinguished when: -

1. The machine is first powered up.
2. An E/Stop has occurred.

Pressing this button should 'pull in' the safety relay and illuminate the lamp. If this button stays unlit then an E/Stop is still pressed. The above points should be investigated.

3.1.4 Green Services On Button

This button is used to bring services onto the machine providing the safety relay has 'pulled in'. If the orange E/Stop Reset lamp/button is extinguished, this button will have no effect. When the machine is prepared a.c. power will be restored to the Inverter Drive motor, although the track will not start until the Track button on the HMI is pressed.

The button should be pressed for at least one second to allow the Toman circuit to be reset, otherwise the heaters will not be powered up, until either this button is pressed and held down for more than a second or the operator presses the appropriate 'On' button on the proprietary Toman controller.

3.1.5 Pallet Release Push Buttons (by stations 1 and 2)

Behind the track by each of the two manual load stations is a green mushroom push button that allows the pallet in station to be released, provided that the track is running "at speed". That is about 2½ seconds after the track has started to accelerate to speed. Pallets are prevented from leaving **all** stations (including auto stations) if the track is not running, or is decelerating to a stop. Pallets are prevented from leaving station 1 if the buffer area between station n1 and 2 is "full" – i.e. the Buffer full sensor detects a pallet for more than one second.

The PLC will check that the pushbutton is released once the pallet has left the station before waiting for the button to be pressed again to initiate the release of the next, and subsequent, pallets. In this way if the button is jammed down only the first pallet will release. A diagnostic message will be displayed if the button fails to release for whatever reason.

3.1.6 Pallet Release Foot Switch (below stations 1 and 2)

Underneath the track by each of the two manual load stations is a foot switch that is connected in parallel with the corresponding station green mushroom Pallet Release pushbutton. This may be pressed using the foot instead of the hand pushbutton. The same restrictions for operation apply.

3.2. Machine Start Up and Operation

Normal machine operation is dependent on a good ac power supply to the machine being present and sufficient air at the pressure as detailed in section 1.6 of this manual. Prior to switching the machine on the operator should ensure that the manual air cut-off switch (in the pneumatic panel) is turned to allow air onto the machine. The mains isolator on the door of the main control panel should be turned on. The HMI display will remain blank for about 5 seconds after the machine is powered up, followed by HMI initialisation screens which take about 30 seconds to complete, after which time the operator may be presented with a 'part-filled' screen for the first few seconds. The HMI will always power up showing the grey Main Screen. Do not touch the HMI screen until the Main screen is displayed.

The operator should check that both E/Stop buttons are released. The orange Machine Enable button will be extinguished, indicating that the safety relay has not been energised to its operating condition. This illuminating button must be pressed first to 'pull in' the safety relay and illuminate the lamp. Next, the green Services On push button must be pressed and held down for more than one second to bring services onto the machine. These services comprise air pressure, the a.c. power to the Toman Heat Stake unit and the inverter drive motor (to power the track conveyor motors). Until the Heat Stake unit reaches the required temperature band a diagnostic message will be displayed on the HMI to advise the operator of the errant condition. If the Heat Stake unit is not in the required temperature band or the track is not running, pallets will be prevented from being released from station 3 buffer stop.

For any pallets to be released from any station, or its associated buffer, the Track must be running at speed. If the machine is in Auto Mode (as indicated by a green Auto soft-key in the bottom left hand side of the HMI) then when pallets arrive at automatic stations, and the track is running, they will be processed. Pallet release can be prevented if the track is stopping, for whatever reason (E/Stop, circuit breaker trip, Track Stop button pressed) or if the buffer associated with the next station is full.

Note – there is no buffer full associated with the track between stations 2 and 3 so station 2 pallets may release when the button is pressed, if the track is running. There is no buffer at station 4 and normally station 3 will release directly to station 4. Under exceptional circumstance, if the pallet at station 4 is prevented from leaving the pallet at station 3 may leave **BUT** no pallets will be released from station 3 buffer until the pallet is being processed at station 4. Similarly pallets will be held at station 3 buffer when the pallet released from station 3 is a reject, until the operator has manually unloaded the pallet and acknowledged the action, of the red Reject Acknowledge screen on the HMI.

To summarise :-

1. Check E/Stop buttons are released.
2. Check guards are closed.
3. Press orange Machine Enable button, followed by pressing and holding the green Services On button.
4. Select Auto mode (unless not required) on HMI
5. Wait until Heat Stake at temperature.
6. Start Track.– machine will start to operate

3.2.1 Normal Machine Operation.

Assuming the machine has been 'prepared' and services turned on to the machine, the Heat Stake is at temperature and the track is running the machine can be operated. For normal production Auto mode (as selected by the HMI soft-key) should be selected. Manual mode is generally only used when setting up the machine to perform specific checks on the machine operation.

The operation of each station will be described in detail in the following sections.

To summarise :-

1. Select Auto mode (unless not required) on HMI
2. Ensure Heat Stake is at temperature.
3. Start Track using HMI.
4. Pallets will cycle as required (Operator releasing on Manual stations when appropriate).
5. Automatic stations will operate.

3.2.2 Station 1 (Manual)

Pallets will arrive at this station from the buffer stop just 'upstream' on the track from the main operator station stop (Stn 1). If more than a specific number of pallets are queuing at the buffer stop then pallets will be prevented from releasing at station 4. The operator is required to load onto the four fixtures on the pallet the parts required by the customer build instructions. Once all the required operations are finished the operator should press the pallet release push button or associated foot switch.

If the buffer at the next station (Stn 2) is full or the track is stopping / stopped the PLC will 'remember' that the pallet was to be released and this condition will be latched in (provided the PLC is not powered down) and when the track has again accelerated up to speed and the next buffer is no longer full the pallet will be released, the station stopper will be lowered.

The PLC will check that the pushbutton is released once the pallet has left the station before waiting for the button to be pressed again to initiate the release of the next, and subsequent, pallets. In this way if the button is jammed down only the first pallet will release. A diagnostic message will be displayed if the button fails to release for whatever reason.

As the pallet is released from the main station stop, if a pallet is waiting at the buffer stop just 'upstream' from the station this will automatically be released once the main station stopper has been de-activated. The main station stopper is deactivated once the pallet is no longer detected by the 'In Station' proximity switch. When the pallet that was at the buffer is no longer detected there the Buffer stop will return upwards to stop any other pallets from arriving. All pallets are stopped at the buffer, even if the station is empty, to ensure only one enters at any time.

3.2.3 Station 2 (Manual)

Pallets will arrive at this station from the buffer stop just 'upstream' on the track from the main operator station stop (Stn 2). If more than a specific number of pallets are queuing at the buffer stop then pallets will be prevented from releasing at the manual station 1. The operator is required to load onto the four fixtures on the pallet the parts required by the customer build instructions, to complete the addition of all sub-components to be staked for each of the four assemblies. Once all the required operations are finished the operator should press the pallet release push button or associated foot switch.

If the track is stopping / stopped the PLC will 'remember' that the pallet was to be released and this condition will be latched in (provided the PLC is not powered down) and when the track has again accelerated up to speed the pallet will be released, the station stopper will be lowered.

The PLC will check that the pushbutton is released once the pallet has left the station before waiting for the button to be pressed again to initiate the release of the next, and subsequent, pallets. In this way if the button is jammed down only the first pallet will release. A diagnostic message will be displayed if the button fails to release for whatever reason.

As the pallet is released from the main station stop, if a pallet is waiting at the buffer stop just 'upstream' from the station this will automatically be released once the main station stopper has been de-activated. The main station stopper is deactivated once the pallet is no longer detected by the 'In Station' proximity switch. When the pallet that was at the buffer is no longer detected there the Buffer stop will return upwards to stop any other pallets from arriving. All pallets are stopped at the buffer, even if the station is empty, to ensure only one enters at any time.

3.2.4 Station 3 Heat Stake (Automatic)

Pallets will arrive at this station from the buffer stop a short distance 'upstream' on the track from the main automatic heat stake station, provided the track is running, the Heat Stake unit is at temperature, and the last pallet released from station 4 was not a reject and has already arrived at station 4.

When the pallet arrives at the Heat Stake station (Stn 3) the lift and locate will be raised, lifting the pallet off the track and absorbing the reaction force during the following staking operation. Provided the previous Toman 'End of Cycle' signal has gone off and the circuit breakers associated with the heater power are correct and the Head is detected as being up and not already down, the staking operation will commence and a 'Start' signal issued to the Toman equipment. The staking heat will then be lowered onto the waiting pallet.

The PLC will wait until the Toman indicates it is at the end of the heating phase the PLC checks that the Heat Stake head down proximity switch is made and that the head up switch is off. The Heat Stake unit then does a cold air blow before retracting the staking head. When the Heat Stake head down switch goes off, indicating that the heat has started retracting the lift and locate unit also retracts, lowering the pallet back onto the track. The PLC waits until the Heat Stake head up switch is made before releasing the pallet, assuming the track is running. If the Watchdog timer had tripped during the staking operation and the operator had pressed the red Acknowledge Watchdog button on the HMI, or if a circuit breaker in the main CPR cabinet associated with the Heat Stake unit tripped during the machine cycle, the parts would be labelled as reject and would not be automatically unloaded at station 4.

If there is no pallet at station 4 stopper (the last one had already been released), and the pallet leaving station 3 is not a reject then as the pallet is released from station 3 main stop, if a pallet is waiting at the buffer stop just 'upstream' from the station this will automatically be released once the main station stopper has been de-activated. The main station stopper is deactivated once the pallet is no longer detected by the 'In Station' proximity switch. When the pallet that was at the buffer is no longer detected there the Buffer stop will return upwards to stop any other pallets from arriving. All pallets are stopped at the buffer, even if the station is empty, to ensure only one enters at any time.

Depending on operator action at stations 1 and 2 there are times when the unloaded pallet at station 4 cannot be released, because the buffer at station 1 is full, so to prevent the side legs on the assemblies from wilting (because of the close proximity of the heater unit to them) the pallet at station 3 must be released, even though there is no empty space at the station 4 main stopper. Under these circumstances **NO** pallet is released from station 3 buffer until the pallet that was released from station 3 arrives at station 4 stopper (once the held platen there was released).

Pallets will also be held at station 3 buffer if the last released pallet from station 3 was a reject. Pallets can be rejected, either because they have taken too long to process (Watchdog) or if a circuit breaker in the main CPR cabinet associated with the Heat Stake unit tripped during the machine cycle. As rejected pallets cannot be automatically unloaded at station 4, they must be unloaded manually, with the guard door open and the machine E/Stopped – which would interrupt the next machine cycle if station 3 were processing a pallets, or else the operator would have to wait until the heat stake operation finished. For this reason the buffer at station 3 hold the next pallet until the operator has unloaded the pallet at station 4 and indicated that this has been achieved by pressing the large yellow Reject Acknowledge button on the red HMI screen.

3.2.5 Station 4 Unload (Automatic)

Pallets will arrive at this station directly from station 3. If there is still a pallet in station when station 3 releases its pallet, then the buffer associated with **station 3** will be prevented from releasing pallets into station3 until **station 4** has stated to process the newly released pallet. Similarly if a Reject pallet is released to station 4, this will prevent **station 3 buffer** from releasing pallets until the operator has removed the parts and pressed the yellow Reject Acknowledge button on the HMI.

When the pallet arrives at the Unload station (Stn 4) the status of the pallet, as remembered by the PLC from station 3 (Reject or not) will be checked. If the pallet is a Reject then the red Reject Acknowledge screen will be displayed. The operator is required to open the guard door near station 4 stopper and remove **ALL** parts from the pallet (including any un-assembled 'bits') before pressing the yellow Reject Acknowledge button on the HMI. The machine E/Stop circuit must be reset, the Services On pushbutton pressed and if the stoppage was only short and the Heat Stake unit is still within temperature range the Heating delay can be overridden. Then the track should be started and the pallet at station 4 automatically released (assuming there is room at station 1 buffer) and the pallet held at station 3 buffer will be released to the heat stake position.

Normal operation on **non-reject** pallets is that when a new pallet is detected at the stopper for station 4 the lift and locate will be raised, lifting and accurately locating the pallet off the track ready for the removal of the assemblies. The position of the pick and place unit is checked to be directly above the pallet and that all grippers are open and then both vertical slide will be lowered to place the grippers around the four waiting assemblies on the pallet. Once both vertical slides are fully down the grippers will close.

Once all grippers are closed the vertical slide will be raised to lift the slides and the gripped parts clear of the pallet. Once this has occurred the lift and locate is lowered and pallet may be released, depending on the status of the track conveyor (running) and whether there is room detected at station 1 buffer, in a manner similar to all the other stations. At the same time the horizontal slide on the pick and place moves to the first put down position (part way along the stroke of the horizontal slide) above the off-take (unload) conveyor, on the side nearest to the main pallet track. There is no physical stop at this position, the air being locked into both ends of the cylinder to stop the motion. At this point the Running Total and Total Ever counters are incremented. Provided the unload conveyor is clear; i.e. the last parts unloaded have been moved away, the first vertical slide will be lowered and then the grippers associated with **that slide only** are opened to release just those two parts onto the unload conveyor. After a slight delay to allow the grippers to open the first vertical slide is raised again clear of the conveyor.

When the first vertical slide is fully up, the pick and place horizontal slide is moved to the second put down position, at the end of the linear slide. The second vertical slide will be lowered and then the grippers associated with that slide are opened to release the last two parts onto the unload conveyor. After a slight delay to allow the grippers to open the second vertical slide is raised again clear of the conveyor. Once both slides are fully up the horizontal pick and place returns to a position above the track, irrespective of whether the unloaded pallet has been released or not and waits until the next **non-reject** pallet arrives at the stopper and is located.

Depending on operator action at stations 1 and 2 there are times when the unloaded pallet at station 4 cannot be released, because the buffer at station 1 is full. In these circumstances a second pallet will queue behind the unreleased pallet at station 4 having been already released from station 3 to prevent the side legs on the assemblies from wilting. Once there is room for the unloaded pallet to be released it will occur, and the queuing pallet will be stopped by the stopper at station 4; and then depending on its status will be dealt with in the appropriate manner.

3.2.6 Stopping at End of Cycle

To stop the machine at the End of a Cycle, the operator merely has to stop the track, by pressing the green Track Running button on the HMI to show it as a red Track Stopped button. As each of the stations finishes its current operation (assuming it had already started) on the pallet already in the station the station will stop. No pallets will start to be released once the track stop has been initiated, however, if the stopper at any station had already started to retract (descend) prior to the track stop being requested, the pallet will continue with its release.

3.3 Machine Stop

The machine is designed to operate continuously when the track is running, provided the manual stations continue to release parts. To stop the machine the operator should press the Track Running button to change it to Tracked Stopped. All stations will then complete the current cycle and not start a new one.

If the machine is going to remain unattended for any extended period of time it is recommended that empty pallets are released from stations 1 and 2 before the machine be E/Stopped. In this way no parts will be left in station 3 when the machine is E/Stopped. Overnight, weekends or holidays it is recommended that once the machine has been emptied and E/Stopped, the mains isolator be turned off to removed all power from the machine and render it 'completely safe'. Following this procedure will allow an easy and fault free start up when power is re-applied, as detailed in other sections.

3.4 Emergency Stop (E/Stop) and Recovery

An Emergency Stop (E/Stop) condition occurs **ANY** time either of the two emergency stop buttons (one by the HMI and one near the end of the cutting table) is pressed.

E/Stopping should be used in the event of an emergency when the machine has to be stopped. When either red mushroom button is pressed all air pressure (high and low pressure) is removed from the machine system. The bulk of the control outputs on the PLC are removed, with the exception of the Cycle complete lamp. AC power is removed from the Heat Stake unit and inverter controller (and hence track motors). Once either mushroom button has been pressed the respective E/Stop button will latch in and will require twisting to allow the button to release. However, just releasing the button will not re-enable the machine and the procedure detailed in section 3.4.1 must be followed.

3.4.1 Recovery from an E/Stop Condition

The operator should check that both E/Stop buttons are released, one on the HMI panel and one near the unload conveyor. All the guard doors should be closed. The orange Machine Enable button will be extinguished, indicating that the safety relay has not been energised to its operating condition. This illuminating button must be pressed first to 'pull in' the safety relay and illuminate the lamp.

Next, the green Services On push button must be pressed to bring services onto the machine. These services comprise air pressure and the a.c. power to Heat Stake unit and track motor inverter drive. Once the Heat stake unit is fully at temperature the track should be started, although it may be desirable to do this before if the heat stake has to fully warm up and there was a pallet with parts left in station 3, stopping the track once the pallet is released.

To summarise :-

1. Correct fault and check E/Stop buttons are released.
2. Check guard doors closed
3. Press orange Machine Enable button, followed by green Services On button.
4. Check Heat stake at temperature
5. Start track by pressing red track Stopped button on HMI to allow it to change to green Track Running.

3.5. Description of HMI Screens and Soft-keys

Each of the screens available on this machine is described briefly below. Included in the Manual are printouts of all the screens showing all the text and icon areas – note that not all the texts and icons in the prints will be shown on the screens at the same time or under normal operation.

3.5.1. "Standard" HMI Soft-keys (situated towards the bottom of each HMI screen)

There is space for six soft-keys (which are touch sensitive) near the bottom of most screens on the HMI display. On some screens only a selection are provided. On some of these screens, some of these "standard" soft-keys will be available, and in general, they will appear in the same place on each screen. For brevity, the function of each of the suite of "standard" soft-keys is described below, and reference will only be made as to their availability when discussing individual screens.

The 'Auto/Manual' soft-key is normally situated on the left of the screen and is effectively a toggle action, allowing either Automatic or Manual mode of operation to be selected. The current mode of operation is indicated with the alternative mode being available on pressing the soft-key. If Auto Mode is selected, indicated by a green background of the soft-key, a red Auto legend, and the soft-key appearing 'depressed'; then pressing the soft-key once will select Manual / Step Mode. The machine will then stop at the end of the current action/ motion, allowing "Jog" control or "Step-by-Step" operation by the Step soft-key provided on the HMI. When the machine is in Manual / Step Mode the background colour of the soft-key 'top' will be red, the legend will show 'Manual' (in white characters). When in Manual / Step Mode machine operation is "interrupted", although all the outputs and cylinders are active. **MANUAL / STEP should not be used as a substitute for E/Stopping the machine** and work should not be carried out on the machine under MANUAL / STEP conditions only, as the machine is still **potentially dangerous**. Pressing the soft-key a second time will select Auto again, and machine operation will be enabled.

Auto or Manual mode may be selected at any time during machine cycles and the machine will operate in the appropriate manner.

The 'Step' soft-key (blue background with red characters) is only active in the Manual mode of operation and is used to 'Jog' the machine through the pre-programmed sequence a step at a time. The action of the Step soft-key is momentary and multiple steps will not occur if the soft-key is held in. The soft-key must be released and pressed a second time for another step – provided the machine mechanisms are in the correct position to allow a subsequent step to happen.

The 'Hold/Next Message' soft-key allows scrolling diagnostic messages (described later) to either be held, so that the information can be more fully interpreted, or read by others; or quickly manually scrolled onto subsequent messages (assuming more than one exists) to check what messages are active. Holding the soft-key in will inhibit the PLC automatically scrolling to the next message, whilst rapid pressing and releasing of the soft-key will allow several messages to be quickly scrolled through – a feature usually only required when there are multiple messages to be displayed.

Certain faults, when detected by the PLC, only occur momentarily and are consequently “latched” so that the condition and the reason for incidents can be noted some time after the problem occurred. This is particularly true if the air pressure “glitches” low during machine operation, or if the operator requires the Heat Stake operation to be re-tried after a Watchdog timeout.. The 'Fault Acknowledge' soft-key allows latched faults to be reset and, in some instances, enables the machine to continue its operation.

If the 'Lamp Test' soft-key is pressed then the beacons will flash slowly irrespective of any other conditions, provided the DC power supply and PLC outputs are OK and the PLC is running. This is also used as a confidence check that the PLC is operative.

The 'Menu' soft-key (only available on the Main Screen) enables the HMI to display a second screen where more options and information (Total ever made) is available.

The 'Service' soft-key enables the HMI to display a second screen where machine specific information is displayed.

The 'Return' soft-key enables the HMI to return from one screen to either the Main or Menu screens.

3.5.2. Diagnostic Messages

The area at the bottom of most screens is reserved for diagnostic (or fault) messages. Centrally, towards the bottom of the screen is a small, framed rectangle, which will contain a number from 0 to 99. This indicates the number of advisory messages currently active on the system. Provided that the figure is non-zero there will be one or two message lines displayed below the small rectangle. If two message lines are displayed the upper message indicates (in English) the situation, whilst the lower message gives either the technical information (if appropriate) indicating sensor IDs, PLC inputs and outputs and actuator IDs to allow maintenance to easily check the suspect signals, or additional information on how to resolve the condition. When the figure in the frame is zero, and no messages are to be displayed, the area below the rectangle will only display 'Machine OK' with the rest remaining blank.

In most instances the displayed fault must be rectified (i.e. the automation must make the sensor that is not made, or the sensor that is still made must go off, depending on the message being displayed) before the machine can continue its operation. In a few instances the diagnostic message is latched and requires the operator to press the Fault Ack soft-key to remove the diagnostic message (provided the fault is still not present) and allow operation to continue.

If more than one message is indicated then these messages will be displayed sequentially in four second intervals, one replacing the other, until all have been displayed, before "scrolling back" to the first message (if the condition indicated is still valid). Some of these messages may indicate faults which exist preventing the machine from continuing with its normal operation, whilst others will merely advise the operator of the status of parts of the machine, which if not attended to, may later cause a condition which will then stop the machine.

All diagnostic messages include either a **Fault Number** (FNxxx) to aid identification; or else the text "NM" followed by a number is displayed, a note of the number should be made and CPR contacted (contact details are shown on the Service screen). This situation indicates that a fault has been diagnosed that there is **No Message** for, and either there is a problem with the PLC program or the HMI messages, and it should be sorted out in order to allow a meaningful message to be displayed to the operators.

3.5.3. Main Screen

The main screen, with a light grey background, is the screen that will normally be displayed and from this the Menu screen can be accessed, when required – the Menu screen allows access to the Heater Override, Shift Counter and Service screens. Auto/Manual, Step, Hold/Next message, Fault Acknowledge, Lamp Test and Menu Screen soft-keys are provided. Track Stopped / Track Running and Watchdog Acknowledge (when displayed) soft-keys are also provided. Diagnostic messages are displayed (if appropriate) on this screen.

Immediately below the CPR logo a large red Watchdog Acknowledge (or 'Reject' with white characters) button may appear if the Heat Stake cycle has taken too long to complete. A diagnostic message will also be generated. The diagnostic message will indicate that pressing the Fault Acknowledge button will re-try the heat stake operation, or the red Reject (Watchdog Acknowledge) button will abort the current cycle and reject the part.

Centrally, above the standard row of soft-keys, above the white Fault Total box is the Track Start/Stop button, which indicates the current track status (Stopped or Running). When the track is running (or accelerating when starting) the background colour is green, and when stopped (or stopping) the background colour is red. This button is a toggle action, and pressing the button will change the condition from one state to the other.

A subsequent press will return the button and the machine to the initial state, provided the machine is prepared. To start the track the E/Stop circuit must be reset, the machine prepared and air pressure stabilised, and all the motor circuit breakers OK and no inverter alarm. The inverter controls the acceleration / deceleration and the speed of the track. If any of the above list is not correct the track will be automatically stopped and pressing the button will be ignored and the track will remain stopped until the problem is sorted and the button then pressed.

To the right hand side of the screen are three coloured total boxes, with black, yellow and green backgrounds (reading from top to bottom). The middle box has black figures whilst the outer two have white figures. These indicate, in order top to bottom, the pre-loaded Shift Target, the current calculated Running Target, and the current actual Running Total. None of these figures can be manipulated here. The Shift Target is entered elsewhere as the total production required per complete shift. The Running Total is an incrementing total (one part at a time) based on the time into the shift and the average required production rate, which itself is calculated by dividing the Shift Target by the shift time (7 hours 50 minutes). The Running Total is incremented by four (the number of assemblies contained on one pallet) when station 4 pick and place arrives at the first unload position.

3.5.4. Menu Screen

The Menu screen, with a light grey background, can be accessed from the Main screen by pressing the Menu soft-key, or from the Counter Reset and Service screens when the Return soft-key is pressed. This screen is very similar to the Main Screen but with extra buttons and indicators. Auto/Manual, Step, Hold/Next message, Fault Acknowledge, Lamp Test, Service and Return (to allow the Main screen to again be displayed) soft-keys are provided. There is no track control or indication on this screen and no Watchdog Acknowledge button will appear. Two blue buttons below the CPR logo allow access to two further screens, as indicated by their names. Diagnostic messages are displayed (if appropriate) on this screen.

Below the CPR logo, to the left the Heater O/Ride (Override) button allows access to a screen where maintenance and other authorised personnel can override the normal wait for the heat stake head to reach a valid average temperature. To the right of this is the Shift Counter button which is password protected so that only authorised personnel may display the Counter Rest screen and reset the shift counter (once the previous shift totals has been manually recorded) or alter the Shift Target value, if required. Below the Heater override button is a 'subdued' grey button (with dark grey characters) allowing personnel to login the password to enable access to the counter screen.

To the right hand side of the screen are four coloured total boxes, with purple, black, yellow and green backgrounds (reading from top to bottom). The lower three boxes display the same figures as shown and already discussed on the Main screen. The upper purple field indicates the total number of completed good assemblies unloaded by the machine, and is used for reference only.

When Manual is selected a third button, with a red background and the legend Toman Operate in yellow characters, is visible. It is located between the Shift Counter button and the Shift and Running Target fields. This button should only be pressed by experienced knowledgeable personnel as, provided the machine is prepared, it enables the lift and locate at station 3 to rise and the Heat Stake head to descend; irrespective of the where the station sequence is, or where a pallet is, and as a consequence damage to the heater, pallet and products could result.

3.5.5. Heater Override Screen

The Heater Override screen, with a purple background and white characters, can only be accessed from the Menu screen when the blue Heater O/ride button is pressed. Only the Return soft-key from the standard set is available on this screen. A large cyan (turquoise) button in the central of the screen labelled Heater Delay Over-ride is the only other button on this screen. The button will only appear once ALL the heaters are in the required temperature range. Diagnostic messages are displayed (if appropriate) on this screen.

Centrally, below the white warning and information text is the large cyan Heater Delay Over-Ride button. Normally when warming up from cold the heat stake unit thermocouples will reach the designated temperature in about 2 to 3 minutes. If the normal temperature range is not yet achieved the button will not be visible and will be deactivated. Once the thermocouples show the 'heart' of the block is at temperature the bulk of the lower surface of heat stake tooling will be at a lower temperature than that indicated and there is a delay in the PLC which prevents the station 3 operating (specifically station 3 buffer from releasing) until this time has elapsed.

If the machine has only been E/Stopped for a **SHORT** period of time (say to quickly open the door and remove rejected parts from the pallet at station 4) and is subsequently reset, the temperature of the heat stake unit will not have dropped far and the ten minute delay will then be excessive. Under these circumstances it is permissible to press the button. Once the function has been activated the Return soft-key may be pressed to return the HMI to displaying the Main screen.

3.5.6. Counter Reset Screen

The Counter Reset screen, with a light grey background, can only accessed from the Menu screen by pressing the blue Shift Counter button, once password authorisation has been achieved. This screen is very similar to the Menu Screen but with less buttons and indicators. Auto/Manual, Step, Hold/Next message, Fault Acknowledge, Lamp Test and Return soft-keys are provided. There is one large green Reset Counters button on the right hand side. Diagnostic messages are displayed (if appropriate) on this screen.

Note that the password authorisation required to access this screen will automatically be rescinded after a delay of one minute, necessitating the re-entry of the password to re-enter the screen once the operator has left the Counter screen. Provided the screen is still displayed the operator has full access to the Reset button and the alteration of Shift Target, even after the 1 minute timeout.

Mid-way down the right hand side is the large green Reset Counters button (with yellow characters). When this button is pressed BOTH the yellow Running Target and the green Running Total fields will be reset to zero.

To alter the Shift Target the black Shift Target field should be pressed. This causes the display to 'pop-up' another grey screen with a numeric keypad to allow a new value to be entered. Minimum acceptable value is 10; with a maximum value of 10,000. Values are saved by pressing the enter key (↵ character) on the keypad

Once all the required changes have been made the operator may press the blue Return soft-key to return to the Menu screen.

3.5.7. Reject Acknowledge Screen

The red Reject Acknowledge screen is displayed automatically when a pallet containing parts already labelled as reject (from the heat stake operation) arrive at station 4 stopper. No soft-keys from the standard set are shown on this screen. A large yellow button in the lower half of the screen labelled Reject Acknowledge is the only button on this screen. Diagnostic messages are displayed (if appropriate) on this screen.

When this screen is displayed the operator **MUST** E/Stop the machine and open the guard door near station 4 to allow access to the pallet and remove the four rejected products (all parts of the aborted assemblies) before pressing the large yellow Reject Acknowledge button and resetting the E/Stop and preparing the machine and starting the track. It may be necessary to over-ride the heater warm up delay to allow the machine to operate. Once the operator has pressed the Reject Acknowledge button the HMI will automatically return to displaying the Main or Menu screens.

3.5.8. Service Screen

The Service screen, yellow characters on a black background, is selected from the Menu screen, when the blue Service soft-key is pressed. This screen displays information about the machine (Job and Works Order Numbers) and the machine suppliers/builders, including address and phone/fax number and who to contact in the event that service/help is required. When contacting CPR the original Job Number, as displayed on the screen should be quoted to identify the equipment, especially on sites where more than one CPR machine has been installed. Hold/Next, Fault Ack, Lamp test and Return soft-keys are provided. Diagnostic messages are available on this screen.

3.5.9. Diagnostic Message Listing

| | Diagnostic words (Top Line) | Technical Description (Bottom Line) |
|----|--|--|
| 0 | | |
| 1 | FM01 Machine not Prepared - CM (i/p X1) not on, | Reset E/stop, M/c Enable and press Service On for 2 secs |
| 2 | NM 02 | |
| 3 | FM03 No Air Pressure | PSA (i/p x0) is off when CM (i/p X1) on |
| 4 | FM04 Low Air Pressure or Flow | PSA (i/p x0) "blipped" off, press Fault Ack to reset. |
| 5 | FM05 Heat Stake Circuit Breakers not healthy | CB5 and/or CB12 (i/p X3) is off. |
| 6 | FM06 Track Motor Circuit Breakers not healthy | CB6 to CB11 (i/p X4) is off. |
| 7 | FM07 Track Inverter in Alarm condition | E520S ALARM signal (l/p X2) is on |
| 8 | NM 08 | |
| 9 | FM09 Heat Stake Watchdog tripped, Is Heater on? | Press Fault Ack to retry, or Red Reject to remove |
| 10 | FM10 Heat Stake Warm time not done | |
| 11 | FM11 Staking Unit out of temp range, x1F not on. | Stn 3 no buffer release. Heat O/ride inhibited |
| 12 | NM 12 | |
| 13 | NM 13 | |
| 14 | NM 14 | |
| 15 | NM 15 | |
| 16 | NM 16 | |
| 17 | FM17 Stn 1 Release button/pedal still pressed | Pb1/1 or Fs1/1 (i/p X8) is on - it should be off |
| 18 | FM18 Stn 2 Release button/pedal still pressed | Pb1/2 or Fs1/2 (i/p XC) is on - it should be off |
| 19 | NM 19 | |
| 20 | NM 20 | |
| 21 | NM 21 | |
| 22 | NM 22 | |
| 23 | NM 23 | |
| 24 | FM24 Last Stn 3 reject pallet not arrived stn 4? | Press Fault Ack in Manual to continue |
| 25 | FM25 Stn 3 Lift unit not @ reset posn | Px4/3 (X10) not on when Sv3B/3 (Y32) is on |
| 26 | FM26 Stn 3 Lift unit not @ operate posn | Px3/3 (XF) not on when Sv3A/3 (Y31) is on |
| 27 | FM27 Stn 3 Lift unit still @ reset posn | Px4/3 (X10) still on when Sv3A/3 (Y31) is on |
| 28 | FM28 Stn 3 Lift unit still @ operate posn | Px3/3 (XF) still on when Sv3B/3 (Y32) is on |
| 29 | FM29 Heat Stake head not @ retract | Px6/3 not on |
| 30 | FM30 Heat Stake head still @ retract | Px6/3 still on |
| 31 | FM31 Heat Stake head not @ advance | Px7/3 not on |
| 32 | FM32 Heat Stake head still @ advance | Px7/3 still on |
| 33 | FM33 Stn 4 P&P Leading Vertical not @ up | Px3/4 (X14) not on when Sv3/4 (Y36) is off |
| 34 | FM34 Stn 4 P&P Leading Vertical not @ down | Px2/4 (X13) not on when Sv3/4 (Y36) is on |
| 35 | FM35 Stn 4 P&P Leading Vertical still @ up | Px3/4 (X14) still on when Sv3/4 (Y36) is on |
| 36 | FM36 Stn 4 P&P Leading Vertical still @ down | Px2/4 (X13) still on when Sv3/4 (Y36) is off |

| | Diagnostic words (Top Line) | Technical Description (Bottom Line) |
|----|---|---|
| 37 | FM37 Stn 4 P&P Trailing Vertical not @ up | Px5/4 (X16) not on when Sv4/4 (Y37) is off |
| 38 | FM38 Stn 4 P&P Trailing Vertical not @ down | Px4/4 (X15) not on when Sv4/4 (Y37) is on |
| 39 | FM39 Stn 4 P&P Trailing Vertical still @ up | Px5/4 (X16) still on when Sv4/4 (Y37) is on |
| 40 | FM40 Stn 4 P&P Trailing Vertical still @ down | Px4/4 (X15) still on when Sv4/4 (Y37) is off |
| 41 | FM41 Stn 4 P&P Horizontal not @ Pallet (track) | Px11/4 (X1C) not on when Sv7B/4 (Y39) is on |
| 42 | FM42 Stn 4 P&P Horizontal not @ 2nd Unload | Px10/4 (X1B) not on when Sv7A/4 (Y38) is on |
| 43 | FM43 Stn 4 P&P Horizontal still @ Pallet (track) | Px11/4 (X1C) still on when Sv7A/4 (Y38) is on |
| 44 | FM44 Stn 4 P&P Horizontal still @ 2nd Unload | Px10/4 (X1B) still on when Sv7B/4 (Y39) is on |
| 45 | FM45 Stn 4 P&P Horizontal not @ 1st Unload | Px9/4 (X1A) not on, Sv7A/4 & 7B/4 (Y38&39) off |
| 46 | FM46 Stn 4 P&P Horizontal still @ 1st Unload | Px9/4 (X1A) still on, Sv7A/4or 7B/4 (Y38/9) on |
| 47 | FM47 Stn 4 P&P Horiz. not detected 1st Unload prox | Px9/4 (X1A) did not on. Press Fault Ack after unload. |
| 48 | FM48 Stn 4 Offtake conveyor not clear when required | Pe8/4 (X19) not on for some time |
| 49 | FM49 Stn 4 P&P Leading Gripper not @ open | Px6/4 (X17) not on when Sv5B/4 (Y48) is on |
| 50 | FM50 Stn 4 P&P Leading Gripper still @ open | Px6/4 (X17) still on when Sv5A/4 (Y47) is on |
| 51 | FM51 Stn 4 P&P Trailing Gripper not @ open | Px7/4 (X18) not on when Sv6B/4 (Y4A) is on |
| 52 | FM52 Stn 4 P&P Trailing Gripper still @ open | Px7/4 (X18) still on when Sv6A/4 (Y49) is on |
| 53 | NM 53 | |
| 54 | NM 54 | |
| 55 | NM 55 | |
| 56 | NM 56 | |
| 57 | NM 57 | |
| 58 | NM 58 | |
| 59 | NM 59 | |
| 60 | NM 60 | |
| 61 | NM 61 | |
| 62 | NM 62 | |
| 63 | NM 63 | |
| 64 | NM 64 | |
| 65 | NM 65 | |
| 66 | NM 66 | |
| 67 | NM 67 | |
| 68 | NM 68 | |
| 69 | NM 69 | |
| 70 | NM 70 | |
| 71 | NM 71 | |
| 72 | NM 72 | |
| 73 | NM 73 | |
| 74 | NM 74 | |
| 75 | NM 75 | |

| | Diagnostic words (Top Line) | Technical Description (Bottom Line) |
|----|------------------------------------|--|
| 76 | NM 76 | |
| 77 | NM 77 | |
| 78 | NM 78 | |
| 79 | NM 79 | |
| 80 | NM 80 | |
| | | |

3.6 Beacon Quick Reference Guide

PLEASE NOTE :- when any of the HMI Lamp Test soft-keys are pressed then **only the** lamps under PLC control will be flash quickly ($\frac{1}{3}$ second on and $\frac{1}{3}$ second off) while the soft-key is pressed, irrespective of any other conditions that exist, assuming that the PLC is running and the lamp bulb operational.

| | Beacon Off | Beacon On | Flashing Slowly | Flashing Quickly |
|-------------------------------------|---|--|--|---|
| Fault Beacon Red | Machine either powered off, or machine is prepared with no detected faults. | Machine is not prepared. Close guards, reset E/Stop circuit and press green services on push button. | A notifiable fault has been detected. See HMI diagnostic messages for more info. | Lamp Test soft-key is oppressed on HMI. |
| Auto Running Beacon Green | Machine not prepared – air pressure not stabilised | Machine is Auto and Track running | Machine is Manual or Track stopped | Lamp Test soft-key is oppressed on HMI. |

3.7 Password

This section has been deliberately printed on a separate piece of paper so that the rest of this description may be copied without this sheet to allow operators to read the bulk of it, without divulging the passwords to them and compromising the integrity of the system. Currently there is only one valid password for the system

The level 1 password is 57475, the CPR phone number, which is displayed on the Service Information screen. This password is currently not used.

The level 2 password is 62354, the CPR fax number, which is displayed on the Service Information screen. This password is required to access the Shift Counter Reset screen.

When the login button is pressed the HMI will automatically bring up a grey box with a keypad to allow a password to be entered. The authorised user may need to press the 0-9 key to display a numeric keypad to enable the password numbers to be entered, depending on whether the HMI has been powered down since the last time password entry was attempted. Once the password has been entered the enter key (shown with the ↵ symbol) should be pressed. The 'pop-up' screen will disappear and the grey field in the centre of the displayed screen will indicate if the password level has been authorised,

The password access will automatically be rescinded after one minute.

4.0 TRANSPORT AND INSTALLATION

4.1 Transport and Handling

To prepare for transport:

- Isolate electrics and disconnect.
- Isolate the pneumatics and disconnect.
- Evacuate all air from the system.
- Ensure that all loose items are secured prior to transportation.

Transportation of the machine can be undertaken by forklift truck and pallet truck.

4.2 Installation

To site.

- Site the machine.
- Level off the machine.
- Pneumatically and electrically reconnect the machine.
- The machine should be commissioned by CPR personnel prior to being run by

Please Note: The strip down and installation must be carried out by qualified personnel.

It is the responsibility of UPG personnel to supply and connect the services to the machine.

CPR

AUTOMATION

COUNTER RESET

Shift Target

---0

Running Target

---0

Running Total

---0

**Reset
Counters**

Manual

Step

**Hold/
Next**

-0

**Fault
Ack**

**Lamp
Test**

Return

.....
.....

E 1061

CPR

AUTOMATION

HEATER OVER-RIDE

Maintenance can defeat warming up time by pressing button provided it is visible, indicating unit @ minimum temp

**Heater Delay
Over-Ride**

Return

-0

.....
.....

E 1061

CPR

AUTOMATION

UPG MUGGLE TRACK

Watchdog
Acknowledge

Shift Target

----0

Running Target

----0

Running Total

----0

Track

Manual

Step

Hold/
Next

-0

Fault
Ack

Lamp
Test

Menu

.....
.....

E 1061

CPR

AUTOMATION

MENU SCREEN

Total Ever

-----0

Heater
O/Ride

Shift
Counter

Toman
Operate

Shift Target

----0

Running Target

----0

Running Total

----0

Login

Service

Manual

Step

Hold/
Next

-0

Fault
Ack

Lamp
Test

Return

.....
.....

E 1061

5.0 MAINTENANCE

Daily

- Check the air filter.
- Check pressure gauges.
- Clean machine.
- Check e-stops function correctly.
- Check guard switches work correctly.
- Clean staking tool.

Weekly

- Check cabling and pipes for wear and fatigue.
- Check tooling for wear and fatigue.
- Check conveyor belts.
- Check sacrificial gripper inserts on pick and place system.

6.0 SPARES

A full set of recommended spares are outlined on the parts list – please see section 9.0 General Arrangement Drawings.

7.0 SETTINGS

Pressure switch main air: 5.5 bar

Note: Temperature setting adjusted onsite during commissioning for Toman staking unit.

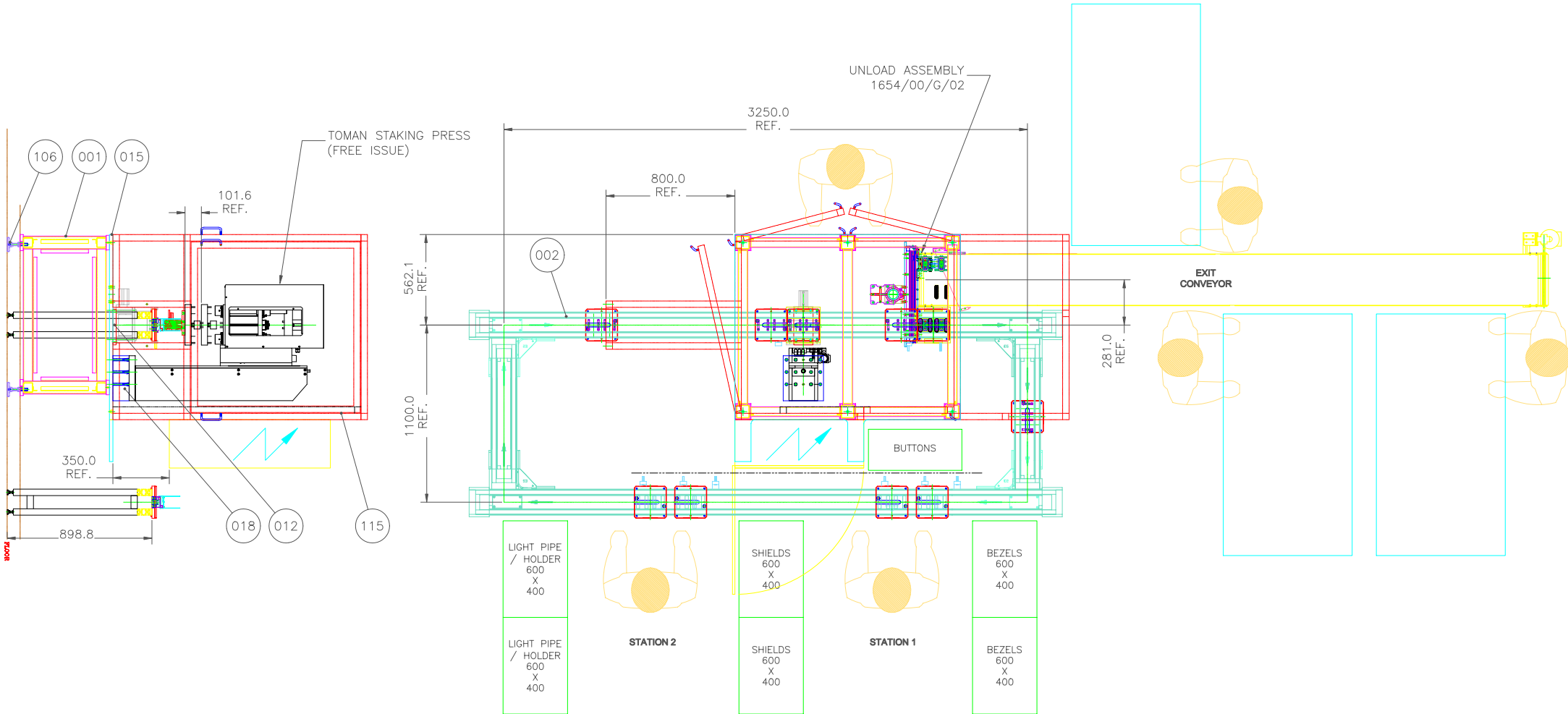
8.0 COSHH DATA

N/A

9.0 GENERAL ARRANGEMENT DRAWINGS



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16



N.B. - EIGHT DIGIT PART NO TO BE STAMPED ON ALL MANUFACTURED PARTS

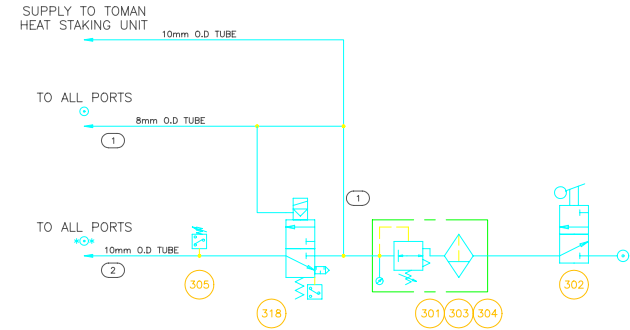
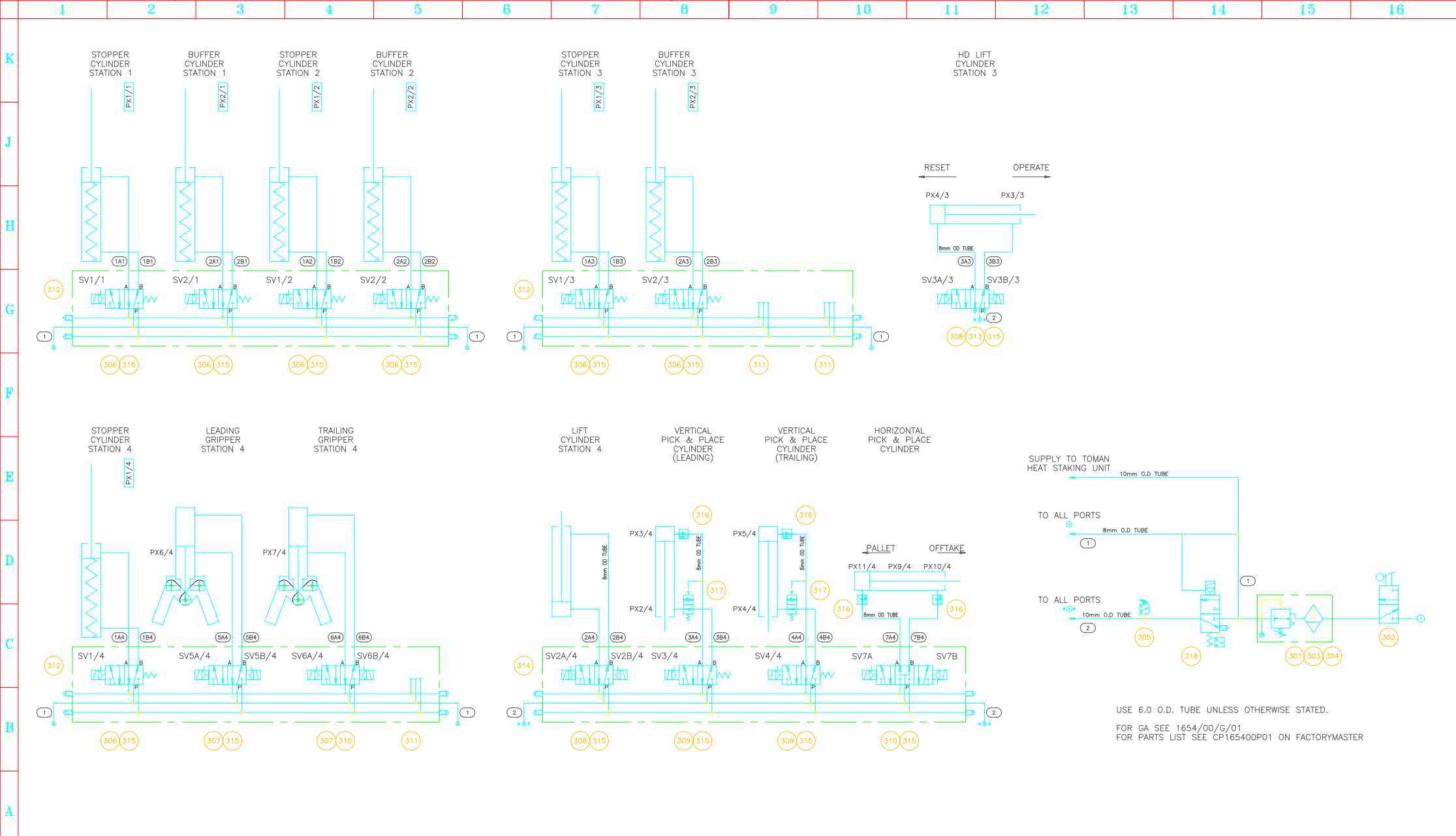
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CPR AUTOMATION LIMITED
 APOLLO
 LICHFIELD ROAD INDUSTRIAL ESTATE
 TAMWORTH - STAFFORDSHIRE
 B79 7TN ENGLAND
 TEL: +44(0)1827 57475 FAX: +44(0)1827 62354
 E-Mail: info@cprautomation.co.uk

GENERAL TOLERANCES: (All dims in mm)
 0 - +0.5
 0.0 - ±0.5
 0.00 - ±0.10
 0.000 - ±0.025
 FLATNESS AND SQUARENESS - 0.05/100
 GENERAL MACHINED FINISH TO BE $\sqrt{32}$
 ALL WELDS TO BE DRESSED. REMOVE SHARP CORNERS
UNLESS OTHERWISE STATED!

| REV | DETAILS | DATE | NAME | REV | DETAILS | DATE | NAME |
|-----|-------------------------------------|----------|--------|-----|---------|------|------|
| 1 | NEW LAYOUT AS REQUESTED BY CUSTOMER | 05/07/07 | BRAD W | | | | |
| 2 | LAYOUT REDEFINED & FINALISED | 14.5.07 | A.T.B. | | | | |
| 3 | FINAL TOMAN PRESS/TOOLING ADDED | 3.9.07 | A.T.B. | | | | |

| TITLE | | | | REV |
|---|----------|--------|--------------|-----|
| MUGGLE ASSEMBLY MACHINE | | | | 3 |
| DATE | DESIGNED | BRAD W | DRG No. | |
| 22/06/07 | | | 1654/00/G/01 | |
| DRAWN | CHECKED | | | |
| BRAD W | | | | |
| C.A.D. DRAWING DO NOT ALTER MANUALLY | | | | |



USE 6.0 O.D. TUBE UNLESS OTHERWISE STATED.
 FOR GA SEE 1654/00/G/01
 FOR PARTS LIST SEE CP165400P01 ON FACTORYMASTER

N.B. - EIGHT DIGIT PART NO TO BE STAMPED ON ALL MANUFACTURED PARTS

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 CPR AUTOMATION LIMITED
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GENERAL TOLERANCES: (All dims in mm)
 0.0 - ±0.5
 0.00 - ±0.10
 0.000 - ±0.025
 FLATNESS AND SQUARENESS - 0.05/100
 GENERAL MACHINED FINISH TO BE \sqrt{R}
 ALL WELDS TO BE DRESSED. REMOVE SHARP CORNERS
UNLESS OTHERWISE STATED!

| REV | DETAILS | DATE | NAME | REV | DETAILS | DATE | NAME |
|-----|---------|------|------|-----|---------|------|------|
| 1 | | | | | | | |

| TITLE | | | REV |
|---|----------|--------------|-----|
| AIR CIRCUIT - MUGGLE TRACK | | | 0 |
| DATE | DESIGNED | DRG No. | |
| 28.09.07 | | 1654/00/P/01 | |
| DRAWN | CHECKED | | |
| B Woolridge | | | |
| C.A.D. DRAWING DO NOT ALTER MANUALLY | | | |

Assembly Details CP1654 - Muggle Pallet Transfer Track - J17911 - W/O 1323 - United Plastics Group Inc

| Item No. | Part Number | Issue | Description/Dimensions | Quantity |
|-----------------|--------------------|--------------|---|-----------------|
| 1 | CP165400G01 | 0 | MUGGLE TRACK MACHINE | 1 |
| 1 | CP165400D01 | 0 | BASE FRAME | 1 |
| 2 | CP165400D02 | 0 | ELCOM CONVEYOR | 1 |
| 3 | CP165400D03 | 0 | UNIT MOUNTING PLATE | 1 |
| 4 | CP165400D04 | 1 | RISER | 2 |
| 5 | CP165400D05 | 0 | PICK & PLACE FRONT PLATE | 1 |
| 6 | CP165400D06 | 0 | GRIPPER PLATE | 4 |
| 7 | * CP165400D07 | 0 | GRIPPER JAW | 2 |
| 8 | * CP165400D08 | 0 | GRIPPER JAW | 2 |
| 9 | CP165400D09 | 0 | Z AXIS PACKER | 2 |
| 10 | CP165400D10 | 0 | FIXTURE NEST BLOCK | 32 |
| 11 | CP165400D11 | 0 | SPACER BLOCK | 2 |
| 12 | CP165400D12 | 0 | H.D. LIFT PACKER | 1 |
| 13 | CP165400D13 | 0 | Z AXIS PACKERS | 4 |
| 14 | CP165400D14 | 0 | CYL. PACKER | 4 |
| 15 | CP165400D15 | 1 | BASE PLATE | 1 |
| 1 | CP165400D15F | 1 | BASE PLATE FLAME CUT | 1 |
| 16 | CP165400D16 | 1 | PALLET (MODIFY) | 8 |
| 17 | CP165400D17 | 0 | MACHINE GUARD | 1 |
| 18 | CP165400D18 | 0 | PRESS PACKER | 1 |
| 19 | CP165400D19 | 0 | PANEL RISER | 2 |
| 101 | SUFS74BS | - | BASE CLAMP 74MM | 1 |
| 102 | SUUS74C800 | - | COLUMN 74MM X 800MM LONG | 1 |
| 103 | SULC74 | - | LEVEL CLAMP | 1 |
| 104 | SUUS74HA | - | HEIGHT ADJUSTER 74MM | 1 |
| 105 | WD4042005 | - | NUT COLLAR M5 | 4 |
| 106 | FBL10 | - | FOOT LEVEL MOUNT L10. DIA 900 MM RUBBER BASED | 6 |
| 107 | * SMMYIB256380 | - | RODLESS CYLINDER - 380 STROKE NO MYIB256-380 | 1 |
| 108 | * SMMGPM20150AXC8 | - | COMPACT GUIDED CYLINDER MGPM20-150A-XC8 | 2 |
| 109 | * SMMHF28D1 | - | GRIPPER MHFZ-8D1 | 2 |
| 110 | * SMDZ73M8F | - | SWITCH REED 24V LED M8 CONNECTOR | 6 |
| 111 | * SMDM9BSAPC | - | SWITCH REED 24VDC LED | 4 |
| 112 | * SMMYJ25 | - | FLOATING JOINT MY-j25 | 1 |
| 113 | IKMES15C2R580HS2M4 | - | LINEAR RAIL NO. MES15 C2 R580 HS2/M4 | 2 |

*Items marked *, are recommended spares*

Assembly Details CP1654 - Muggle Pallet Transfer Track - J17911 - W/O 1323 - United Plastics Group Inc

| Item No. | Part Number | Issue | Description/Dimensions | Quantity |
|-----------------|--------------------|--------------|--|-----------------|
| 114 | EL07080010 | - | CONVEYOR SYSTEM NO. 07080010 | 1 |
| 115 | MRQ102307REVO | - | MACHINE GUARD NO. Q102307REVO | 1 |
| 116 | IFE11197 | - | CABLE STRAIGHT M8 CONNECTOR 4 X PUR CABLE/5M | 12 |
| 117 | * IFIF5936 | - | SENSOR INDUCTIVE M12 CONNECTOR M12 SENSING RANGE 4MM | 14 |
| 118 | IFE10701 | - | CABLE ANGLED M12 CONNECTOR 4 X PUR/PVC CABLE/10M | 14 |
| 119 | * IFOJ5030 | - | SENSOR THRO BEAM TRANSMITTER M8 CONNECTOR | 1 |
| 120 | * IFOJ5031 | - | SENSOR THRO BEAM RECEIVER M8 CONNECTOR 10M RANGE | 1 |
| 2 | CP165400C01 | 5 | CONTROLS - MUGGLE TRACK | 1 |
| 401 | EDDRA04 | - | DOCUMENT POCKET - SELF ADHESIVE - A4 | 1 |
| 402 | EDMAS1008030 | - | ENCLOSURE 1000MM x 800MM x 300MM | 1 |
| 403 | MIQ01CPU | - | CPU 14K STEPS | 1 |
| 404 | MIQ35BE | - | BASE UNIT MAIN 5 SLOT | 1 |
| 405 | MIQ61P | - | POWER SUPPLY 110-230VAC FOR Q SERIES PLC | 1 |
| 406 | MIQG60 | - | DUMMY MODULE | 1 |
| 407 | * MIQX80 | - | INPUT CARD 16 IN SOURCE PNP | 2 |
| 408 | * MIQY80 | - | OUTPUT CARD 16 OUT TRANSISTOR SOURCE PNP | 2 |
| 409 | MIE1061 | - | HMI 6" TOUCH SCREEN COLOUR | 1 |
| 410 | RUMC99 | - | LEAD MODEM MALE 9 PIN - FEMALE 9 PIN | 1 |
| 411 | MICAB17 | - | CABLE D-SUB 25 PIN MALE TO MINI DIN 6 PIN | 1 |
| 412 | RUWETD33EU | - | MODEM WESTERMO 12-36 VDC | 1 |
| 413 | MZC60HD101 | - | CIRCUIT BREAKER MCB 1A 1 POLE TYPE D | 2 |
| 414 | MZC60HD104 | - | CIRCUIT BREAKER MCB 4A 1 POLE TYPE D | 3 |
| 415 | MZC60HD116 | - | CIRCUIT BREAKER MCB 16A 1 POLE TYPE D | 1 |
| 416 | RS2119314 | - | FAN 230V 19W | 2 |
| 417 | RS2469388 | - | SOCKET 13A 1 GANG | 2 |
| 418 | RS417307 | - | NEUTRAL LINK 250A | 1 |
| 419 | RS261154 | - | DIODE TYPE IN4002 1A | 3 |
| 420 | * RS415193 | - | FUSE 32M40 A2 | 1 |
| 421 | RS425550 | - | EARTH BAR 8 WAY | 1 |
| 422 | RS470386 | - | TELEPHONE SOCKET | 1 |
| 423 | RS507450 | - | PLUG & LEAD TYPE 1 FOR FANS | 2 |
| 424 | RS508510 | - | FILTER COVER | 2 |
| 425 | RS512581 | - | FAN GUARD 120X120 | 2 |

*Items marked *, are recommended spares*

Assembly Details CP1654 - Muggle Pallet Transfer Track - J17911 - W/O 1323 - United Plastics Group Inc

| Item No. | Part Number | Issue | Description/Dimensions | Quantity |
|----------|--------------|---------------|---|----------|
| 426 | RS178181 | - | SWITCH GUARD TROJAN 5 | 4 |
| 427 | RS1930479 | - | ACTUATOR FULLY FLEXIBLE FOR TROJAN 5 | 4 |
| 428 | TEABL7RP2405 | - | POWER SUPPLY 230V - 24VDC 5A | 1 |
| 429 | TELC1D38BD | - | CONTACTOR 38A 24VDC COIL | 1 |
| 430 | TELADN31 | - | CONTACTS AUXILIARY FRONT 3N/O 1 N/C | 1 |
| 430 | TEXPSAC5121 | - | RELAY SAFETY CAT 3 3 N/O 1 N/C | 1 |
| 431 | TEXVBC21 | - | BASE UNIT & COVER 24VDC | 1 |
| 432 | TEXVBC2B3 | - | LENS GREEN 24VDC | 1 |
| 433 | TEXVBC2B4 | - | LENS RED 24VDC | 1 |
| 436 | TEXVBZ02 | - | TUBE AND FOOT 22MM ID X 100MM LONG | 1 |
| 437 | TEGS1GB30 | - | ISOLATOR 3 POLE 63A | 1 |
| 438 | TEZB4BA3 | - | BUTTON FLUSH PUSH GREEN | 1 |
| 439 | TEZB4BS54 | - | BUTTON PUSH E/STOP RED | 2 |
| 440 | TEZB4BV013 | - | PILOT LIGHT WHITE LED | 1 |
| 441 | TEZB4BVB1 | - | BODY SUB-ASSEMBLY WHITE 24VDC | 1 |
| 442 | TEZB4BW0B51 | - | CONTACT N/O WITH PILOT LIGHT YELLOW | 1 |
| 443 | TEZB4BW353 | - | BUTTON ILLUMINATED PUSH YELLOW | 1 |
| 444 | * | TEZB4BZ101 | - CONTACT 1 N/O AND BODY | 2 |
| 445 | | TEZB4BZ141 | - BODY/CONTACT ASSEMBLY 2NC 1NO | 2 |
| 446 | | TEZBY2101 | - LEGEND BLANK PLATE | 5 |
| 447 | | TEZBY9330 | - LEGEND PLATE E/STOP | 1 |
| 448 | * | OMMY4IN24VDC | - RELAY 24V DC | 2 |
| 449 | | OMPYPF14AE | - RELAY BASE | 2 |
| 450 | | TEZBY2330 | - LEGEND E/STOP | 1 |
| 451 | | TEXAPJ1201H29 | - ENCLOSURE 80MM X 80MM 1 HOLE YELLOW LID | 1 |
| 452 | | TEZB4BZ103 | - CONTACT 2 N/O AND BODY | 1 |
| 453 | * | TEZB4BR3 | - BUTTON PUSH GREEN 60MM DIA | 2 |
| 454 | * | TELC1D09BD | - CONTACTOR 9A 24VDC COIL | 1 |
| 455 | | TEXAPM1201H29 | - ENCLOSURE 80MM X 80MM 1 HOLE | 2 |
| 456 | | TEGV2ME06 | - BREAKER MPCB 1-1.6A | 4 |
| 457 | | TEGVAE11 | - CONTACT AUXILIARY 1 N/O 1 N/C | 5 |
| 458 | | RS2604373 | - RELAY POSITIVE GUIDED CONTACTS 4PST | 1 |
| 459 | | RS2604389 | - BASE RELAY DIN MOUNT G7S | 1 |
| 460 | | RS2110698 | - FOOTSWITCH HEAVY DUTY | 2 |

*Items marked *, are recommended spares*

Assembly Details CP1654 - Muggle Pallet Transfer Track - J17911 - W/O 1323 - United Plastics Group Inc

| Item No. | Part Number | Issue | Description/Dimensions | Quantity |
|-----------------|--------------------|--------------|--|-----------------|
| 461 | RS3986632 | - | SOCKET OPTO ISOLATOR | 1 |
| 462 | RS3986711 | - | OPTO ISOLATOR 24VDC 1A | 1 |
| 463 | MZC60HD125 | - | CIRCUIT BREAKER MCB 25A 1 POLE TYPE D | 2 |
| 464 | MZ26924 | - | CIRCUIT BREAKER MCB CONTACT AUXILIARY | 3 |
| 465 | MIFRE520S22KEC | - | INVERTER SINGLE PHASE IN 2.2KW | 1 |
| 466 | MIFFRE520S26ASC1 | - | FILTER FOF E520 INVERTER 2.2kW | 1 |
| 467 | FT1261713 | - | TRANSFORMER 230V-110V 2.75kVA | 1 |
| 468 | MZ19665 | - | CIRCUIT BREAKER RCBO 16A 30mA 2 POLE | 1 |
| 3 | CP165400P01 | 0 | AIR CIRCUIT - MUGGLE TRACK | 1 |
| 301 | * SMAW40F04DE | - | FILTER REGULATOR 1/2" BODY 1/2" PORT AUTO DRAIN WITH GAUGE | 1 |
| 302 | SMVHS40F04 | - | VALVE SHUT-OFF 1/2" PORT | 1 |
| 303 | SMAR40P270AS | - | BRACKET 40 SERIES | 1 |
| 304 | SMY400 | - | SPACER 40 SERIES | 1 |
| 305 | * SMIS100001X215 | - | SWITCH PRESSURE 1/8 BSP 7 BAR 3M LEAD | 1 |
| 306 | * SMSY31405LOUQ | - | VALVE SY3000 SINGLE SOLENOID 2 POSN 24VDC | 7 |
| 307 | * SMSY32405LOUQ | - | VALVE SY3000 DOUBLE SOLENOID 2 POSITION 24VDC | 2 |
| 308 | * SMSY52405LOUQ | - | VALVE SY5000 DOUBLE SOLENOID 2 POSITION 24VDC | 2 |
| 309 | * SMSY51405LOUQ | - | VALVE SY5000 SINGLE SOLENOID 2 POSN 24VDC | 2 |
| 310 | * SMSY55405LOUQ | - | VALVE 5/3 PRESSURE CENTRE SOLENOID OP SY5000 SERIES | 1 |
| 311 | SMSY3000269A | - | PLATE BLANKING KIT SY3000 | 3 |
| 312 | SMSS5Y34104C6FQ | - | MANIFOLD SY3000 SERIES 4 WAY 6.0 TUBE | 3 |
| 313 | SMSY5000271FQ | - | SUB-BASE INDIVIDUAL 5 PORT 1/8" PORTS | 1 |
| 314 | SMSS5Y54104C8FQ | - | MANIFOLD SY5000 SERIES 4 WAY 8.0 TUBE | 1 |
| 315 | SMSY10068A50 | - | LEAD SOLENOID 5 MTR | 19 |
| 316 | SMAS2201F0108S | - | SPEED CONTROL 1/8"BSP - 8MM OD TUBE | 4 |
| 317 | SMASP330F0108S | - | CONTROLLER SPEED/CHECK 1/8" - 8.0MM TUBE | 2 |
| 318 | NOV18D487XB183J | - | VALVE SOLENOID 3/2 24VDC MONITORED 1/2" | 1 |

*Items marked *, are recommended spares*