







# PARKER HANNIFIN

# **OPERATION & MAINTENANCE MANUAL**

FOR

# 400/400 TON FORGING PRESS

## MANUFACTURED BY

## **MACRODYNE TECHNOLOGIES INC.**

Project #: W131513 Equipment Serial #: 131513-MPFG-400/400



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## 1. <u>General</u>

## 1.1 Parts and Service

To obtain parts or service contact:

Macrodyne Technologies Inc. 311 Connie Crescent, Concord, Ontario L4K 5R2

Telephone: (905) 669-2253 Fax: (905) 669-0936

The work order number for the 400/400 Ton Forging Press is W131513. Please reference this number when calling for service.



## 1.2 Warnings

The press has been designed to meet the intent of the following safety standards:

ANSI B11.2 Hydraulic power presses – safety requirements for construction care and use

ANSI B11.19 Performance criteria for safeguarding (Machine tools)

The owner/operator should be familiar with these safety codes and the requirements pertaining to the care and use of such equipment.

- 1. The equipment covered in this manual was designed, rated and supplied for a specific duty and service.
- Do not use the equipment for any duty or service, other than that originally intended, modify it in any way or utilise non Macrodyne Technologies Inc. supplied replacement parts without consulting Macrodyne. Failure to do so will void all warranties, guarantees and product liability on the part of Macrodyne Technologies Inc.
- 3. If you intend to use the equipment, for any purpose, duty or service, other than as originally supplied, submit the proposed application beforehand to Macrodyne Technologies Inc. for assessment. In such cases, before approving the proposed application, Macrodyne Technologies Inc. reserves the right, where necessary, to change the equipment specifications and/or performance ratings; stipulate changes to the equipment to make it suitable for operation either at the original or modified ratings.
- 4. Modifications can seriously alter safety, performance and operating characteristics. Consequently, always submit any proposed modifications to Macrodyne Technologies in advance.
- 5. Testing and start-up must be done only under the supervision of a Macrodyne Technologies service representative.
- 6. It is important to order replacement parts in accordance with manufacturer's recommendations. If there is any doubt call Macrodyne Technologies Inc. for clarification.
- 7. Please recognise that the drawings, parts lists and instructions in this manual are provided only as guides to identifying and specifying components requiring replacement and to aid in carrying out maintenance and repairs.



Therefore, you should not, without the expressed permission of Macrodyne Technologies, use any drawings in the Manual to manufacture, or fabricate spare or replacement parts in any way, or obtain them from suppliers other than Macrodyne Technologies.

- 8. When not in use the equipment must be stored as indicated in this manual to maintain warranty.
- 9. The press structure has been thermally stress relieved during manufacture. It is imperative that no welding whatsoever be done to the press frame without consulting Macrodyne. This may result in cracking. This especially includes *"striking an arc"* on the frame.

## WARNING

Any welding to the press structure in a high stress area will immediately void all warrantees.

Always consult Macrodyne Technologies Inc. prior to any welding being done on the press.

10. When operating or working on this equipment always:

- Observe all precautions and warnings.
- Be thoroughly familiar with the manual.
- Follow the proper operating procedures and avoid unauthorized short cuts.
- Do not switch on the power to the press until you are certain that it is appropriate to do so. Ensure that no personnel are working on or near the press.
- Before starting the press always ensure it has been properly maintained and lubricated.
- For presses equipped with access ladders, only one person should be on the ladder at a time.
- 11. This equipment, as supplied by the manufacturer, does not include any production tooling and /or certain associated equipment required for operation. Such items are the responsibility of the customer or owner/operator.



- 12. It is the customer's or owner/operator's sole responsibility to ensure that, at all times, including after each set-up of production tooling and/or associated equipment, operation of the Macrodyne technologies equipment and the associated production processes meet all conditions and comply with all regulations concerning elimination an prevention of hazards with respect to the workplace, personnel and the environment.
- 13. Only fully trained and qualified personnel must operate this equipment.
- 14. Do not place any object or allow any person to place body part under the raised cylinder or slide (ram) unless the cylinder or slide (ram) is physically blocked or locked in the raised position and the lock-pins are engaged or its weight resting fully on the blocks.
- 15. If there is a warning sign or lock on a device, do not switch on that device until the person who placed it there has removed the sign or lock.
- 16. Do not start the press until all potential hazards to personnel and equipment have been eliminated.
- 17. Ensure all guards and protective devices are in place before operating the equipment. Use emergency stop for emergency purposes only. Do not use it as a convenient method of stopping the press under normal operating conditions.



## 1.3 Press Specification

The Macrodyne Press will be a hydraulic, down stroking, monolithic frame type designed for a hot metal forming application. The press will be equipped with following primary components and features:

- Thermally stress relieved, 800 ton monolithic frame designed and optimised using finite element analysis software.
- One (1) heavy-duty, single-acting 400 ton main pressing cylinder with integral double acting high speed closing and opening cylinder.
- Heavy-duty, fabricated, hold down slide, with an adjustable, self-lubricating, four point guide system,
- Two (2) double-acting 200 ton die hold down cylinders.
- Monitored, double lock pin arrangement to secure the hold down frame in the upper position during set up and maintenance functions,
- High strength steel link system to connect the hold down slide to the die shoes (Vblocks)
- Set of four (4) precision leveling and vibration reducing press mounts
- Part chute to underground quench with reject system for nonconforming parts
- Self-contained multi-pump based hydraulic drive package using logic valve & manifold technology and associated hydraulic piping package. The hydraulic unit is mounted on top of the press in order to conserve floor space.
- Parker hydraulic & pneumatic components will be used to the extent possible
- Hydraulic system designed to use fire retardant hydraulic fluid i.e. "Quintolubric"
- Hydraulic platform with painted sheet metal enclosure and ladder for ease of access to the hydraulic system and for aesthetic and sound attenuation reasons.
- Comprehensive, Allen Bradley Compactlogix PLC based electrical control package complete with A.B. 1000, graphic based, operator interface assembled into the operator's control panel, including the following control and operating features;
  - Multi-mode capabilities with jog functions,
  - Programmable tonnage & speed control for the forging cylinder,
  - Forging cylinder position control and monitoring by linear transducer
  - Programmable tonnage control for the hold down cylinders,
  - Hold down slide position control and monitoring by linear transducer
  - Position teach cycle for press to set global parameter
  - Process complete detection and confirmation
  - Confirmation that part has dropped out of the die and press
  - Recipe storage for 100 parts
  - Screens to show status of the press
  - Security screens,
  - Fault diagnostics and alarm summaries
  - Maintenance and preventative maintenance screens
- Open drip proof electrical motor(s) and reduced voltage motor starter(s).



- One (1) operator's foot pedal to initiate press cycle and T-stand with dual palm buttons, E-stop, press stop and jog up pushbuttons. Both will plug into the main control panel.
- A tri-colour stack light is provided to indicate status of the press.
- Operator Safety Package comprised of a powered sliding Lexan window on the front and a hinged enclosure with Lexan window for the rear of the press, including all mounting brackets, safety interlocks and control integration. Press safety will conform to OSHA standards.
- Press is arranged for mounting on any suitably reinforced floor/foundation, designed and constructed by others. Macrodyne will provide foundation layout with static and dynamic loadings.



## 1.4 Press Data

| General                             |              |  |  |  |  |
|-------------------------------------|--------------|--|--|--|--|
| Maximum hold-down Force             | 400 tons     |  |  |  |  |
| Maximum die opening force           | 5 tons       |  |  |  |  |
| Maximum forging tonnage             | 400 tons     |  |  |  |  |
| Maximum Punch stripping force       | 10 tons      |  |  |  |  |
|                                     |              |  |  |  |  |
| Press bed size                      | 48" X 37.25" |  |  |  |  |
| Opening between frames              | 56"          |  |  |  |  |
| Forging cylinder stroke             | 32"          |  |  |  |  |
| Open daylight under hold down frame | 17.5/12"     |  |  |  |  |
| Hold down cylinder stroke           | 24"          |  |  |  |  |
|                                     |              |  |  |  |  |
| Overall width of press (L-R)        | 92""         |  |  |  |  |
| Overall depth of press (F-B)        | 60"          |  |  |  |  |
| Overall height of press above floor | 20'-0"       |  |  |  |  |
| Approx. weight of press             | 76,500 lbs.  |  |  |  |  |
|                                     |              |  |  |  |  |
| Speeds                              |              |  |  |  |  |
| Forging cylinder approach speed     | 400 in/min   |  |  |  |  |
| Pressing speed                      | 75 in/min    |  |  |  |  |
| Slow return speed                   | 75 in/min    |  |  |  |  |
| Fast return speed                   | 720 in/min   |  |  |  |  |
|                                     |              |  |  |  |  |
| Hold-down frame approach speed      | 300 in/min   |  |  |  |  |
| Clamping speed                      | 75 in/min    |  |  |  |  |
| Slow return speed                   | 75 in/min    |  |  |  |  |
| Fast return speed                   | 300 in/min   |  |  |  |  |
|                                     |              |  |  |  |  |
| System Pressure                     |              |  |  |  |  |
| Hydraulic system operating pressure | 4600 PSI     |  |  |  |  |
|                                     |              |  |  |  |  |
| Installed Power                     |              |  |  |  |  |
| Forging and clamping horsepower     | 200 HP       |  |  |  |  |
| Filter and cooling pump horsepower  | 10 HP        |  |  |  |  |
| Motor Voltage                       | 480/3/60     |  |  |  |  |
| Control Voltage                     | 24 VDC       |  |  |  |  |
|                                     |              |  |  |  |  |



## 1.5 Service requirements

| SERVICE                     | DETAILS           |  |              |   |  |  |  |  |  |  |
|-----------------------------|-------------------|--|--------------|---|--|--|--|--|--|--|
| ELECTRICAL POWER            |                   |  |              |   |  |  |  |  |  |  |
| HORSE POWER                 | KW                | VOLTAGE                                  | AMPS         | REMARKS   |  |  |  |  |  |  |
| 210                         |                   | 460                                      | 290          | Main disconnect rated at 400-amps   |  |  |  |  |  |  |
|                             | COOLING WATER     |  |              |   |  |  |  |  |  |  |
| FLOW (GPM)                  | TEMPERATURE (° F) |  |              |   |  |  |  |  |  |  |
| 10                          | 85                |  |              |   |  |  |  |  |  |  |
|                             | COMPRESSED AIR (C | LEAN AND DRY, NO                         | LUBRICATION) |   |  |  |  |  |  |  |
| FLOW (CFM)                  | PRESSURE (PSI)    |  |              |   |  |  |  |  |  |  |
| 15 SCFM                     | 90                |  |              | <sup>1</sup> / <sub>2</sub> " NPT<br>connection,<br>located near the<br>heat exchanger at<br>the top of the press |  |  |  |  |  |  |
|                             | NITROGEN          |  |              |   |  |  |  |  |  |  |
| VOLUME (gals)               | PRESSURE<br>(psi) |  |              |   |  |  |  |  |  |  |
| 5                           | 1200              |  |              |   |  |  |  |  |  |  |
|                             |                   |  |              |   |  |  |  |  |  |  |
| HYDRAULIC OIL               |                   |  |              |   |  |  |  |  |  |  |
| TYPE                        | VOLUME<br>(gal)   | ISO 4406<br>Target cleanliness<br>rating |              | Oil transferred to the<br>reservoir must be<br>filtered via a 5-micron<br>filter                                  |  |  |  |  |  |  |
| 46 viscosity mineral<br>oil | 350               | 16/4/11                                  |              |   |  |  |  |  |  |  |
|                             |                   |  |              |   |  |  |  |  |  |  |
|                             |                   |  |              |   |  |  |  |  |  |  |
|                             |                   |  |              |   |  |  |  |  |  |  |



## 1.6 Maintenance

### Maintenance Warnings

- 1. Be thoroughly familiar with the equipment operating characteristics.
- 2. Do not carry out maintenance or manually lubricate any of the equipment without the full knowledge of the department supervisor.
- 3. Always maintain good housekeeping around the equipment work area.
- 4. When carrying out maintenance and manual lubrication on the equipment:
  - Post signs and/or barriers at all operator and maintenance control consoles or stations.
  - Switch off, padlock and tag the switches except in special cases requiring the use of electrical power and controls.
- 5. Before switching off electrical supplies lower the slide to the bottom of its travel and shut off the hydraulic power unit.
- 6. When use of power is absolutely required always ensure that all personnel working on the equipment are fully aware of any power-on situation and are properly located to avoid danger.
- 7. Before operating the press, ensure that all maintenance tools and other objects are clear of the slide path of travel.
- 8. Before disconnecting any hydraulic lines, lower the slide to the bottom of its travel shut off the hydraulic power unit. Wait for the slide to settle to the bottom of its stroke.
- 9. Check all hydraulic lines for signs of pressure before disconnecting.
- 10. Carry out regular inspections to ensure lubrication piping and/or fittings are functioning properly.
- 11. Always discard all hydraulic fluid spilled. Never return spilled hydraulic fluid to the hydraulic unit tanks.
- 12. Do not change the PLC control logic without consulting Macrodyne Technologies. Severe damage to equipment can result from incorrect programming.
- 13. Do not use high voltage to test any control circuit containing electronic components.



## <u>General</u>

- 1. It is important to follow the recommended maintenance programs and procedures to ensure trouble-free operation and to avoid hazards to personnel and equipment. Proper lubrication is extremely important.
- 2. This section of the manual outlines the following maintenance programs and procedures:
  - Regular Maintenance,
  - Periodic Maintenance
  - Lubrication and Hydraulic Instructions
- 3. Do not neglect equipment that is going to remain or be taken out of service for more than three months. Instead, follow the "Long Term Storage and Shut down Instructions". Typically, such periods occur prior to installation, following installation, prior to commissioning and/or active service, during extended periods involving repairs and refitting to this and/or associated equipment and during shut downs or lay ups.
- 4. Before servicing any equipment, including routine and periodic maintenance and lubrication, follow these steps to avoid hazards to personnel and equipment.
- 5. Macrodyne Technologies recommend that the owner maintain a log of all operator daily checks, maintenance procedures, checks or repairs.

### **Regular Maintenance**

### **Daily Maintenance:**

- 1. Check the maintenance log. Ensure that the equipment has been properly inspected, serviced, maintained and lubricated.
- 2. Ensure all hydraulic fluid levels are correct and filters clean.
- 3. Check for any leaks and report these to the supervisor.
- 4. If necessary, carry out the appropriate maintenance and lubrication programs.
- 5. Check the emergency stop and press stop controls are working properly and that all guards are in place.
- 6. Carefully check for specific damage or deterioration and carry out any repairs necessary.



- 7. Test the equipment and ensure it is functioning properly before using it for any regular production operations.
- 8. Check the alarm history log on the operator interface for dirty filter alarms. Replace filters as indicated.

## **Monthly Maintenance**

In addition to the daily scheduled maintenance procedure:

- 1. Check the guide adjustment. Ensure that the guide clearance is correct.
- 2. When a guide liner shows significant wear, replace it. Normally, after prolonged use of the press, all liners will exhibit the same degree of wear and should be replaced together.
- 3. Lubricate in accordance with the Hydraulic Fluid instructions. (If applicable)
- 4. Always replace the filter elements immediately after initial start up.
- 5. Visually inspect the level of the hydraulic fluid and the conditions of the pump. If the fluid level is low, add hydraulic fluid as specified in the hydraulic fluid instructions.
- 6. Check the condition of the hydraulic fluid for any foaming or air entrainment. Sample hydraulic oil on a regular basis and have the sample analysed as mentioned in the hydraulic power unit section of this manual.
- 7. Check the air breather for contamination. Clean the elements, if necessary.
- 8. Monitor the oil temperature and compare to previous readings. If there is a significant change in the steady state operating temperature this should be investigated.
- 9. Using a test gage, monitor the various test ports provided. Compare the measurements to the values previously logged. Adjust relief valve settings, where applicable, as required. Note down any adjustments that are required in the log. Frequent re-adjustment indicates wear in pressure relief components and should be investigated.



## Yearly Maintenance

In addition to the daily and weekly scheduled maintenance procedure:

- 1. Carry out a major maintenance inspection. Thoroughly check the condition of all major equipment components, including all pumps, motors and filters, and clean, service, adjust or replace items in accordance with component manufacturer's recommendation.
- 2. Check for correct alignment of pumps, motors, cylinders, additional energy converters and pipelines under normal operating pressure and temperature.
- 3. Lubricate in accordance with the lubrication schedule.
- 4. Draw an oil sample from the oil reservoir for analysis. Contingent on the analysis, treat or replace as advised
- 5. Re-calibrate pressure transducers, linear transducers, temperature switches and all other control devices that require calibration and setting.
- 6. Re-calibrate proportional valves, valve amplifiers, pressure and speed control loops.
- 7. Dress or replace the main motor starter contacts as required.

## **Every Three Years**

In addition to the yearly, daily and weekly scheduled maintenance procedure, schedule a period to carry out a major inspection of all equipment and components. Macrodyne Technologies can provide personnel to assist in both the inspection and any necessary repairs.

Some of the most important items to consider during a major overhaul are:

- Dismantling and checking major guide liners and replacing where necessary
- Seals
- Pumps, valves and piping



## Hydraulic Fluid

- 1. Replacement or reconditioning of hydraulic fluid is often neglected. Long service or external contamination can render it unfit for further use. Regardless of the recommended service intervals, any time there is evidence of contamination, foaming, sludge in the reservoir, sticking valves or discoloration, the fluid should be treated or replaced.
- 2. In certain applications, Macrodyne Technologies lubrication instructions indicate that lubricants should be drained and replaced periodically. Unless otherwise indicated, an equally acceptable practice is to have these lubricants analysed by the lubricant supplier and to follow their recommendations with respect to cleaning, reconditioning or replacement.
- 3. Always fill the hydraulic power unit with pre-filtered oil. Filter oil through a 5micron filter, or finer.
- 4. As the filters become plugged, and the clogged filter switch indicates this condition, change the elements to stop contamination of the system or bypassing of the filters.
- 5. Procedure for Replacing the Hydraulic Fluid:
  - Open the drain valve located on the bottom of the hydraulic tank.
  - Drain the hydraulic fluid.
  - Inspect and clean the reservoir. Always use gum solvent oil and a brush to clean the sides and bottom. Do not use a cloth for cleaning or wiping. This can leave lint on the surface.
  - Replace the filters
  - Refill reservoir with flushing oil.
  - Run the re-circulation pump (DO NOT OPERATE THE CONTROLS) for approximately half an hour. Then operate the control valves with no work going through the machine for at least 1-1/2 hours.
  - Drain the used flushing oil into suitable containers and discard it. Ensure drainage is complete.
  - Close the drain line.
  - Replace the filters, once more.
  - Refill the reservoir with the correct grade of hydraulic fluid. See the lubrication section for details.
  - Flush the system. The oil volume contained within the system should be flushed through the filters 150 to 300 times. (Refer to the installation checklist for details). During flushing, all of the filters must be checked at short intervals and the filter elements changed as required.



• Check the oil level.

## 1.7 General Arrangement



Figure 1 - Press general Arrangement

The general arrangement of the press is shown above and consists of the following components:

- Press Assembly
- Electrical panel, pedant and T-stand



- 2. Mechanical
  - 2.1 Press Structure



Figure 2 - Press Assembly

The press assembly consists of:

- Press frame
- Hold-down assembly
- Cylinder arrangement
- Front pneumatic safety door assembly





• Platform and hydraulic enclosure with ladder

Figure 3 - Press frame

The press frame is monolithic style, to provide optimum stiffness and guiding capability. The structure is fabricated and thermally stress relieved. It has been designed for the maximum working loads using finite element analysis.

The steel bolster plate is fastened to the press frame. Provisions have been made in the center of the Bolster to allow finished parts to drop though and be diverted to the left or right of the press (see figure 4).





Figure 4 – Part diverter

The diverter chute is located below the bolster and is actuated by a hydraulic rotary actuator. The finished parts are diverted to the left of right of the press and they drop into the customers conveyors.





Figure 5 Hold-down assembly

The hold-down assembly is comprised of a heavy-duty, fabricated, hold down slide with an adjustable, self-lubricating four point guide system. This adjustable, 4 point guiding system is arranged to provide a generous length of contact on the sides of the frame to facilitate precision guiding. The guide wear strips are replaceable and made of high load, high impact and self lubricating composite material. The slide is attached to the cylinder rod by self-aligning split collars with high strength bolts.

Attached to the bottom of the hold down is a high strength steel link system to connect the hold down slide to the die shoes (V- blocks)





Figure 6 - Slide guide block

## WARNING

It is critical that the gap between the guides wear pads and press frame hardened liners are set and maintained to be 0.002" to 0.004". If the gaps are not maintained, serious damage to the hold-down cylinders can occur.





Figure 7 - Cylinder Arrangement

The press is equipped with three (3) heavy duty cylinders. The center cylinder or "punch" cylinder is used for forging and is capable of 400 tons pressing force. Mounted to the top of the punch cylinder is a pullback cylinder. The punch cylinder also has a punch extension in which the customer's different punches are attached. The outer cylinders are attached to the hold down slide and are capable of 400 tons pressing force combined.





Figure 8 – Punch cylinder section view

The punch cylinder is single acting with a 15" bore and 32" stroke. The cylinder contains wiper seals, high pressure seals, guide bands, cylinder bushing and gland ring. Mounted on top is a double acting hydraulic pull-back cylinder equipped with a position transducer.



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Figure 9 – Hold-down cylinder

The hold-down cylinders are double acting with an 11" bore, 10" rod and 24" stroke. Each cylinder contains wiper seals, high pressure seals, guide bands and a gland ring.





Figure 10 – Front pneumatic door



Operator safety package comprised of a pneumatically actuated sliding Lexan window on the front and a hinged enclosure with Lexan window for the rear of the press.



## 2.2 Installation

## **Responsibility**

The responsibility for assembly of the press at the customer's site is dependent on original contract negotiations. Information in this section is based on the customer being responsible for the installation. If the customer is not responsible for field assembly please ignore these sections of the manual.

## **Shipping and Receiving**

The physical size and transport weight restrictions may prohibit the press from being shipped as a complete assembly. Individual components and subassemblies that have been shipped will require re-assembly at the customer's facility. The responsibility for assembly of the press at the customer's site is dependent on original contract negotiations. It is strongly recommended that the equipment be carefully inspected as it is received from the transport company to determine if any damage occurred during transportation. For equipment that is shipped FOB Macrodyne facility, Toronto, Ontario. Macrodyne's responsibility ceases from the time the equipment leaves their door.

## **Cleaning**

If the machine has been disassembled for shipping purposes it is imperative that all machined surfaces be thoroughly cleaned. Mating surfaces must be carefully inspected and if necessary hand stoned prior to erection and re-assembly. Once the machine is standing it should be re-inspected, thoroughly cleaned with all machined surfaces be lightly oiled to prevent rusting. All moving parts and bearing surfaces must be cleaned of all dirt, foreign matter and road grit which may have permeated the tarping during the shipping process. Special attention should be given to the gib areas, cylinder rods safety interlocks and rolling bolster.

Occasionally, depending on how carefully the machine was rigged and handled by the shipper or contracted machinery rigger, it may be necessary to touch up the final coat of paint to enhance or restore the overall "as new" appearance of the machine.

### Foundations of the Press

A solid foundation or press pit is required for proper support of the press. Knowing the overall weight of the press as well as the local soil conditions existing on site, a suitably qualified engineer can determine the type of concrete, the thickness and reinforcement required to adequately support the machine under dynamic loading conditions.



## Levelling the Press

Precise levelling of the press structure is absolutely essential for proper press performance as well as tool performance and part consistency. The press has been designed and manufactured to specific tolerances and assembled in close to perfect level, generating accurate parallelism of the slide with the bolster plate. The press must be levelled in the left-to-right direction to within **0.010**" per foot of the span of the press, and in the front-to-back direction to within **0.006**".

Generally, after the machine is installed some foundation settlement may occur after the first few weeks of operation. The press level should be re-checked after 3-4 weeks and re-levelled if necessary.

The press level should be checked again after 6-8 weeks of operation and relevelled again is required. If no further settlement has occurred the press should be checked again in approximately 6-months and annually thereafter.



## **Slide Guide Adjustment**

Refer to guide block assembly drawings 1513M2.0.0.0-00 and 1513M2.1.0.0-00



It is critical that the gap between the guides wear pads and press frame hardened liners are set and maintained to be 0.002" to 0.004". If the gaps are not maintained, serious damage to the main cylinder can occur.



Figure 13 - Exploded view of Slide Guides



## Checking the guide gap

- 6. Lower the slide/platen onto parallel blocks. Using a level check that the slide/platen and bolster are parallel.
- Using feeler gages or shim stock check that the gap between the hardened liner and wear pad, it should be about 0.002" - 0.004". If the gap is greater it is necessary to re-adjust the guides.

## Adjusting the guide gap

- 8. Ensure that the slide is lowered onto parallel block per 1 & 2 above
- Slightly loosen the 1-1/4" socket head cap screw (Item 5 DWG1513M2.1.0.0-00), jack screws (Item 2 – DWG1513M2.0.0.0-00) and locknuts (Item 11 -1513M2.0.0.0-00). Back off guide blocks a small distance to allow 0.002" -0.004"shimstock to be inserted between the press frame liner and the wear pad.
- 10. Check the position of the slide at each corner. The slide must be in the centre of the press both left to right and front to rear within approx.  $\pm 1/16$ ". If the slide is not in the centre of the press release the cylinder split collars and adjust the position of the slide until centred. Re-torque the split collars.
- 11. Insert a piece of shim stock approximately the same length or longer as the Wear Pad and approximately 1" or more wider so the shim sticks out past the wear pad and can be removed after adjusting. (The thickness of the shim stock should be same as gap tolerance to be achieved). Slide the guide block against the shim stock. Tighten the Socket Head Cap Screws (SHCS) to 30 ft/lb of Torque. Screw in the Jack screws to contact the block and adjust, testing the gap with the shim stock. Once the proper gap is achieved hand tighten the Hex Nut on the Jack Screws. Torque Socket Head Cap Screws to final torque.
- 12. On completion of adjusting all the guides move the slide up and down several times and recheck the gaps.



## 3. Electrical

## 3.1 General

Primary power to the main control panel, designated CP-1, is 460-volts, 3-phase 60-Hz. This panel arrangement is comprised of modular sections of enclosures. The equipment within the main control panels is for power distribution and press control.

The press is also equipped with a pendant control station at the front of the press that is equipped with an Allen-Bradley Panelview Plus 6 HMI and all other pushbuttons, pilot lights and selector switches required for press operation. The press is alos equipped with a foot switch at the front of the press and T-Stand at the rear of the press.

The control voltage used is 24-volts, DC. The The attached load lists reflect power requirements and usage for the press line.



## Press control

The PLC's control and monitor safety devices, proportional and discrete valves required for press operation. The hydraulic unit is equipped with three pumps which are used as follows:

High pressure piston pump #1: Punch motion High pressure piston pump #2: Holdown motion

Speed, pressure and position of the punch and holdown is proportionally controlled.

### **General Operating Instructions**

Operation of the press is accomplished using the various push buttons, selector switches, pilot lights and the operator interface unit on the pendant station

While the majority of control functions will be accomplished using the operator interface unit, certain specific control functions have been assigned to hardwired operator control functions for reasons of safety and accessibility. All push buttons, pilot lights and selector switches have legend plates describing their function. The operator interface unit is graphic based keypad control device that has been configured as a menu-driven interface. This device has been programmed to be intuitive, whereby touching specific field on the screen will either redirect the operator to a new screen, enable data entry, make a selection, etc.

The operator interface units have been configured to provide several levels of security. Upon start up the system will be at the most restrictive level that allows the operator to view most screens and provides access to the functions required for normal operation. Security access codes will be requested for specific displays.

Upon boot up the operator interface unit will automatically display the main menu from where the operator may navigate the system. The following general steps are required to start up the press:

Turn on power Reset the emergency stop circuit Start the motors Reset the press stop circuit Load operating parameters Run the press



## HMI DISPLAYS

The majority of operators have had exposure to PC's, and are familiar with the computer graphic user interface (GUI). The HMI design has followed this approach in designing the various displays. Functions that are intended to replicate operator controls such as pushbuttons will use graphic images to represent these functions. Displays and indicators that that do not require operator input will typically be displayed as black text on gray background; Certain displays will use color to draw attention to their status. Input fields that require operator input or selection are displayed as black text on a white background.

The description of the displays below are based on the order in which they are shown on the base display (main menu).



## **BOOT UP DISPLAY**



This is the boot up display. The "business card" provides Macrodyne contact information. The card is also a pushbutton used to direct the operator to the base display, or main menu.



## **BASE DISPLAY (MAIN MENU)**

| MOTOR<br>CONTROL                 |              | QA and<br>PART DIVERTE<br>CONTROL | R TEMPE             | OIL<br>TEMPERATURE<br>CONTROL |                           | ONENT<br>ATUS<br>NCH  | CLEAN<br>SCREEN                     |  |
|----------------------------------|--------------|-----------------------------------|---------------------|-------------------------------|---------------------------|-----------------------|-------------------------------------|--|
| PRESS<br>OPERATING<br>PARAMETERS |              | GATE<br>CONTROL                   | HOLE<br>LOC<br>CON  | HOLDOWN<br>LOCKPIN<br>CONTROL |                           | ONENT<br>ATUS<br>DOWN | LINEAR<br>TRANSDUCER<br>CALIBRATION |  |
| RECIPE<br>CONTROL                |              |                                   | G SETUP             |                               | PREVENTIVE<br>MAINTENANCE |                       | SECURITY                            |  |
| OPERATING<br>SEQUENCE<br>CONTROL |              | MODE<br>SELECT                    | REFERENCE           |                               | ALARM<br>HISTORY          |                       | CONTROL<br>STATION<br>SELECT        |  |
| randar. Estruar                  | w 0.4 - 2044 | 0.00.00 AM                        |                     |                               |                           | LAMP<br>TEST          | T-STAND                             |  |
| FOOT D                           | y 04, 2014   |                                   | T constant a series |                               | Op                        | erating status        |                                     |  |
| SWITCH SETPOINT MEASURED         |              |                                   | LAST PART           | PART Critical alarms          |                           |                       |                                     |  |
| FORCE (tons) 160 0               |              | 1010 100                          | -                   | End of list                   |                           |                       |                                     |  |
| POSITION (ins)                   | 0.000        | 1.401                             | 2 700               | End of list                   |                           |                       |                                     |  |
| HOLD DOWN                        |              | 2.700                             | Current part name   |                               |                           |                       |                                     |  |
| FORCE (tons)                     | 40           | 0                                 | 2.704               |                               |                           | TO                    |                                     |  |
| OCTION (inc)                     |              | 1 348                             | 2.500               | SEN                           |                           |                       | IOE IS LOCKPIN:                     |  |

The base display is the primary navigation display. Access to other display are directed from this screen. There are certain displays that have secondary, or pop up displays that are locally accessed.



### Base display - lower section of display

The lower section of the display shows critical operating data. This part of the base display will be visible for the majority of the displays as they are selected. When a new display is selected it is overlaid n the upper section of the base display allowing critical operating data to be visible to the operator.



## Press control data

| SMITCH (MINE)        | FOOT PRESS OPERATION<br>SWITCH SETPOINT MEASURED<br>PUNCH |       | ERATION<br>MEASURED<br>NCH | Critical adarms<br>Collarit Mill<br>Urgent Alarma<br>Coll of Mil |              |             |
|----------------------|---|-------|----------------------------|--|--------------|-------------|
| activities (table)   | FORCE (tons)  | 160   | 0                          | Current part name  |              |             |
| FORCE (MHA)          | POSITION (ins)  | 0.000 | 2.765                      | TO 100.6   |              | LOOMMIS     |
| Proderingen ((mille) |   | HOLD  | DOWN                       |  | REPERENCED   | agramentab. |
|                      | FORCE (tons)  | 40    | 0                          |  |              |             |
| POSITION (ins)       |   | 2.698 | This sect                  |  | This section |             |

This section of the display indicates the press force setpoint and measured value. In addition the slide position is shown. The position measurement is referenced to the closed tool.

## Last cycle data



This section of the display indicates the press force value during the last cycle and the formed part leg length. In addition the leg length tolerances and accept/decline indicator are shown.


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## Press Mode select



This is a navigation control selector that calls up the press mode select switch. When pressed the display shown below is displayed.





### Press message status displays



The four status bars provide useful information to the operator. The first area (orange background) provides current status messages. Two alarm status bars are also provided. The red background status bar provides a scrolling display of critical alarms. The yellow status bar provides a scrolling display of urgent alarms. A critical alarm will result in a press trip. An urgent alarm does not trip the press. A secondary alarm history display is also provided that shows more detailed alarm information. The last status bar shows he current part number being run



# SAFETY CONTROL

Press safety control is managed using an independent Omron G9SP safety controller. This devices is a suitably rated safety controller and manages the emergency stop, press stop and gate access control circuits.

#### Emergency stop function

The emergency stop function monitors the emergency stop pushbuttons on the press. Each device in this circuit is equipped with redundant, monitored contacts. The output of the function is connected to interposing contactors with force guided relays. These contacts are also monitored to detect the possibility of "welded" contacts. Emergency stop pushbuttons are located in the following locations:

- Main electrical panel (CP1) on top of the press
- Pendant station
- T-stand

In the event that the emergency stop relay is tripped, the following functions will occur :

- trip the pump motors.
- disconnect control power from the PLC's discrete and analog output circuits.
- disconnect control power from the press stop relay,

thereby stopping the press.

The PLC will automatically initiate an emergency stop if the DC control voltage is too low or, if the PLC's CPU detects an internal fault. The status of each of the emergency stop pushbuttons is also displayed to the operator.



#### Press stop function

The press stop function has the same hardware structure as the emergency stop circuits (dual redundant and monitored circuits). Sensing The press is equipped with yellow press stop buttons located on the T-stand and on the control console. In addition any critical alarm generated by the alarm logic will initiate a press stop.

In the event that the press stop function is tripped all valves that can create motion or generate force will be isolated. The press will stop immediately. Provided none of the above conditions exist, the illuminated press stop reset push button will flash indicating that the relay is waiting to be reset. When the reset push button is pressed the press stop relay will be armed. This is indicated by the reset push button lamp changing from flashing mode to being continuously on.

### WARNING

When the press stop relay is energized the press is operational and can be moved either from the control console or T-stand.



# MOTOR CONTROL



The press is equipped with two hydraulic pump motors provided for the following press function:

Motor M3000 (250 HP) Punch & Holdown functions Motor M3050 (10 HP) Cooling and filtration

M3000 is equipped with and electronic reduced voltage starter (Allen-Bradley SMCFlex). M3050 is started direct on line.

The motors are interlocked through the PLC to prevent operation under specific undesirable conditions. All of the following conditions are required to run the pump motors:

- emergency stop relay is energized
- hydraulic oil temperature not high. (<137 degrees F.)
- hydraulic oil level is not low
- suction lines associated with the pump is open
- motor restart timer has timed out.
- Motor overloads are not tripped



The HMI display provides indication of the interlock conditions for each motor. For normal operation the interlocks should be displayed with green background.

A dedicated HMI display is provided for controlling the pump motor. Status indicators on the motor display indicating one of the following messages:

- Motor off
- Motor ready
- Motor running
- Wait for restart timer

In addition to the above interlocks it is also necessary to start the recirculation pump first.

Each motor control display area follows the same general format. Emulated stop/start pushbuttons are provided. In addition interlocks, runtime indicator and motor status window are provided.



# MOTOR DETAILS

| Wednesday, June 12, 2013 SOFT STARTER STATUS            |  |   |  |  |
|---|--|---|--|--|
| 200   |  | DISABLED                                  |  |  |
|   | Leπ                                      | RUNNING                                   |  |  |
| 160   | Bialat                                   | PHASING                                   |  |  |
|   | Right                                    | PHASING NOT ACTIVE                        |  |  |
| 120   | Pause                                    | STARTING                                  |  |  |
|   | Fause                                    | STOPPING                                  |  |  |
| 80  | Home                                     | ALARM                                     |  |  |
|   |  | FAULT                                     |  |  |
| 40  | End                                      | AT SPEED                                  |  |  |
|   |  | START                                     |  |  |
| 5:21:38 PM  | 5:21:53 PM Next pen                      | BYPASS                                    |  |  |
| READY   |  |   |  |  |
| VOLTS PHASE A-B NNN.N CURRENT (A) NNN.N FAULT CODE NNNN |  |   |  |  |
| VOLTS PHASE B-C NNN.N POWER FAC                         | TOR NN.NN                                |   |  |  |
| VOLTS PHASE C-A NNN.N THERMAL USAGE (%) NNN.N           |  |   |  |  |
|   | Operati                                  | ng status                                 |  |  |
| PENDANT PRESS OPERATION                                 | ESS OPERATION Local Message Display      |   |  |  |
| PUNCH LAST CYCLE  | Critical alarms<br>Local Message Display |   |  |  |
| FORCE (tons) NNN NNN NNN                                | Urgent alarms                            |   |  |  |
| POSITION (ins) NN.NNN NN.NNN NN.NNN                     | Local Message Display                    |   |  |  |
| HOLD DOWN   | Current part name                        |   |  |  |
| FORCE (tons) NNN NNN                                    |  |   |  |  |
| POSITION (ins) NN.NNN                                   | AUTO                                     | TOOL NOT LOCKPINS<br>REFERENCED MIDTRAVEL |  |  |

Motor M3000 is started using an electronic reduced voltage starter. The starter communicates to the PLC via an ethernet connection that allows the motor to monitor phase voltage, current, power factor and thermal capacity. This data is displayed and trended as shown above.



# **OPERATING PARAMETERS**

| OPERATING PARAMETERS |                   |                    |                 |                   |                    |                 |                |
|----------------------|-------------------|--------------------|-----------------|-------------------|--------------------|-----------------|----------------|
|                      | HOLD DOWN         |                    |                 | PUNCH             |                    |                 |                |
| STEEL                | POSITION<br>(ins) | SPEED<br>(ins/min) | FORCE<br>(tons) | POSITION<br>(ins) | SPEED<br>(ins/min) | FORCE<br>(tons) | TIME<br>(secs) |
| TOP STOP             | NN.NNN            |                    |                 | NN.NNN            |                    |                 | N ANNY         |
| DIE CHANGE           | NN.NNN            |                    |                 | NN.NNN            |                    |                 | N.NNN          |
| ADVANCE              |                   | NNN                |                 |                   | NNN                |                 |                |
| PRESSING             | NN.NNN            | NNN                | NNN             | NN.NNN            | NNN                | NNN             | NNN.N          |
| UPPER LIMIT          |                   |                    |                 | N.NNN             | CAVITY CENT        | TER (A1)        | NN.NNN         |
| LOWER LIMIT          |                   |                    |                 | NN.NNN            | LEG LENG           | GTH (A2)        | NN.NNN         |
| KNOCK OUT            | NN.NNN            | NNN                |                 | NN.NNN            | NNN                |                 |                |
| RETRACT              |                   | NNN                |                 |                   | NNN                |                 | . ↓            |

When operating in semi-automatic or automatic modes the operating parameters define how the presses function. The parameters can be adjusted to suit the part being forged. Once the operating parameters have been established the recipe, or tooling data, can be stored by part name/number. Dedicated displays are provided for this function.



### **Operating parameters**

|                    | Position<br>(ins)   | Speed<br>(ins/min)  | Force<br>(tons)   | Time<br>(secs)  |  |
|--------------------|---|---|---|---|--|
| Top stop           | Position at which the<br>punch/holdown starts at<br>and returns to when<br>operating in semi-<br>automatic mode.  |   |   | (3603)  |  |
| Fast advance       |   | Closing speed of the press  |   |   |  |
| Pressing           | Position at which the press will engage the part and apply pressing .   | The speed at<br>which the press<br>will move down<br>during pressing<br>zone.             | The maximum force<br>that the press can<br>be applied when in<br>the pressing zone. |   |  |
| Cycle end          | This is applicable to the<br>punch only. and<br>represents the target<br>position. When this<br>position is reached the<br>downward motion will<br>stop, the press will<br>decompress and move<br>up. |   |   | This allows the<br>punch to hold<br>cycle end position<br>for the duration of<br>this time. |  |
| Knockout           | This define the slow<br>opening distance for the<br>stripping function  | The speed at<br>which the press<br>will open until the<br>knockout position<br>is reached |   |   |  |
| Retract            |   | Opening speed of the press.   |   |   |  |
| Material<br>select | This allows the operator to select whether stainless or brass is being formed.  |   |   |   |  |
| Offset             | This allows to compensate regular length measurement error  |   |   |   |  |



# **Recipe control**



Recipe control allows the operator the ability to store and retrieve parameter data sets. This display is provided to allow the operator to store parameters by name or number. Up to 100 recipes may be stored.



## Storing data



Determine the storage location where the selected recipe is to be stored and using either the arrow keys or numeric entry point select the recipe number. The store (and retrieve) function are two step process. ENABLE STORE DATA and the STORE DATA. After the recipe is successfully stored the message STORE DATA COMPLETE will be shown for five seconds.

When data is stored any information that was stored at the selected location will be overwritten.



# **Retrieving Data**



When data is retrieved from a predefined recipe the data is written directly to the current operating parameters overwriting the data.

The retrieve function is a two step process. Use the PRESS TO RETRIEVE RECIPE button to enable the function; execute the function with the button marked LOAD NEW TOOL DATA. After the recipe is successfully retrieved the message LOAD DATA COMPLETE will be shown for five seconds.



### **Operating sequence**

|                | INININ                  |            | Ĩ          | AUTO                 | TOOL NOT  | LOCKPINS    |
|----------------|-------------------------|------------|------------|----------------------|---|-------------|
| FORCE deers    | HOLE                    | DOWN       |            |                      | \$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$                | 88888888888 |
| POSITION (ins) | NN.NNN                  | NN.NNN     | NN.NNN     | Local                | Message Display                                     |             |
| ORCE (tons)    | NNN                     | NNN        | NNN        | Ur                   | gent alarms   |             |
| PENDANT P      | SETPOINT<br>PL          | MEASURED   | LAST CYCLE | Local<br>Cr<br>Local | Message Display<br>itical alarms<br>Message Display |             |
|                |                         |            |            | Ope                  | rating status                                       |             |
|                | DIVERTER                | SATE RETUR | N          | Local Message Di     | splay   | ₽           |
|                | OPEN GATE               | 1          |            |                      |   |             |
|                | CLOSE HOL               | DOWN       |            |                      |   |             |
|                | RAPID RETR              | RACT       |            |                      |   |             |
|                | GO TO KNOCKOUT POSITION |            |            | STEP WODE            |   |             |
|                | MOVE DIVE               | RTER GATE  |            | NEXT STEP            |   |             |
|                | QUALITY C               | HECK       |            |                      |   |             |
|                | CLOSE PUN               | ICH        |            |                      |   |             |
|                | HOLDOWN GO TO TONNAGE   |            | IAGE       |                      |   |             |
|                | CLOSE SAF               | ETY GATE   |            |                      |   |             |
|                | START                   |            |            | ACTIVE SEQUENCE      |   |             |
|                | OPER                    | ATING SEQU |            |                      |   |             |
|                |                         | CY         | CLE SEQUE  | NCE CONTROL          |   |             |

When operating in the semi-automatic mode the press is controlled by a sequencer. The specific steps are shown in the display. The sequence takes into account the quality assurance check for good/bad parts and diverts the part accordingly.

The sequence can be initiated either from the above display, the footswitch or palmbuttons on the side of the pendant station. The sequence can also be run in a continuous mode or step mode. As the sequence is executed the indicators on the left side will change color indicating that the specific step has been completed. By changing from continuous to step mode during operation the sequence can be paused.



# GATE CONTROL



Although the front safety gate is controlled automatically from within the operating sequence during normal operation, this display allows the gate to be operated manually for maintenance and setup. Solenoid and gate status is indicated on the display.



# **Quality Assurance Monitoring**



During the forging process the cycle end condition is dictated by the punch position. When the punch reaches this position the force should be within predefined limits to constitute a "good part". If the tonnage is outside these limits the part is deemed to be a "bad part".

This display allows the user to define the upper and lower limits and displays the end of cycle position and tonnage of the last cycle. In the event a bad part is detected the part is diverted. The direction of the diversion is dependent on material selection.

This display maintains a count of good parts, total rejects and the consecutive bad parts. The operator can set the number of parts in a batch, the total number of bad parts in a batch as well as the number of consecutive bad parts in a batch. In addition the operator can select if the press is to be tripped if any of these presets is reached. If this occurs the trip will be set once the cycle is completed. A critical alarm will also be posted indicating the cause of the trip. If the trip function is turned off an urgent alarm will be posted when the limit is exceeded, but the press will continue to run.



### MODE SELECT



The press can be operated in either SETUP or SEMI-AUTOMATIC mode

In setup mode the press can be jogged up and down from the pendant, footswitch or rear T-stand. A selector is provided to allow the punch and holdown to operate independently or together. In this mode the press generates limited force and is intended for setting up new tooling and for maintenance.

Semi-automatic, or single stroke, is intended for production. In this mode the cycle can be initiated from the palm buttons on the pendant, or the foot switch.

When the press stop relay is tripped the mode will automatically be switched to setup mode.



### **HYDRAULIC OIL TEMPERATURE CONTROL & MONITORING**



A dedicated display is provided for monitoring and controlling the hydraulic oil temperature. The press is equipped with a water/oil heat exchanger. Cooling water to the heat exchanger is controlled by means of a solenoid valve; the temperature is monitored with a temperature transmitter installed in the oil reservoir.

Provision is made to operate the cooling water solenoid manually or automatically. In manual the operator can open and close the solenoid independent of oil temperature. In automatic the valve will open and close to maintain the oil temperature within a set range. The operator can enter a setpoint at which the valve will open. A non-adjustable dead band of  $5^{\circ}F$  is built into the PLC controls. Once turned on the valve will only turn off when the oil temperature is  $5^{\circ}F$  degrees lower than the setpoint. The recommended operating mode is automatic with a temperature setpoint of  $110^{\circ} F$ .



### LOCKPIN OVERRIDE CONTROL AND MONITORING



The holdown is equipped with two lockpins, one on either side of the press that are used to secure the holdown in the uppermost position in the press. This display is used to monitor the lockpin solenoid and sensor status.

On override is provided to allow the lockpins to be extended and retracted manually. This feature is intended for maintenance purposes only. Use extreme caution when using the overrides.



# **TOOL REFERENCE CONTROL**



The position of the punch and holdown is monitored using a linear position transducers. When installed the absolute position of the transducer is referenced to the bolster. The bolster is deemed absolute zero position. When a tool, or die, is installed it is necessary to reference the tool. This display is provided for that purpose. (Essentially what is done is that the height of the tool is measured by the press.

The reference procedure is as follows:

- 1. Remove all die spacer rings so that the upper tool half can rest on the lower tool half.
- 2. Locate the reference plate on the tool for referencing the punch.
- 3. Start the pump motors and reset the press stop
- 4. Select setup mode
- 5. Jog the punch and holdown down until the upper tool half is completely lowered and the NOT READY TO REFERENCE indicator turns green indicating READY TO REFERENCE.
- 6. Continue to jog down until the REFERENCE ACTIVE display is shown. Release the jog down buttons.
- 7. When the press has completed referencing the TOOL IS REFERENCED display will turn green.

The tool position for both punch and holdown shown should be zero (or close to zero)



## **COMPONENT STATUS DISPLAY - HOLDOWN**



The component status display is intended for maintenance purposes. Information relating the operation of the press is shown. This includes proportional control signals, ON/OFF control signals and the associated pressure and position measurements relating to press operation. A trend display of the proportional signals is also provided.

Two component status displays are provided, one relating to the holdown, the second for the punch.



## **COMPONENT STATUS DISPLAY - PUNCH**





# **PREVENTIVE MAINTENANCE**



A preventive maintenance display is provided to monitor the following:

Checking gibs - based on number of press cycles Oil operating hours - based on motor run time Filters - based on monitoring the filter differential pressure switches.

Gibs must be checked periodically, based on the number of press cycles. The procedure for doing this is covered elsewhere in this manual. Initially the preset should be set at 5000 cycles. After the initial period of operation and the guide gaps have been checked and found to be stable this preset can be increased to 5000 - 10000.

Hydraulic oil will deteriorate with use and should be checked periodically. Oil should be sampled and sent for analysis. Initially set the operating hours to 2000 hours. Based on the results of the oil analysis this number can be increased to 5000 - 10000 hours.

Oil filters are monitored with differential pressure switches across the filters. Once a filter senses a filter is starting to plug the controls monitor the number of cumulative hours the switch senses high differential pressure. When the cumulative time exceeds four hours the press will be tripped. This may take several days.



# ALARM HISTORY

| Alarm history                                     |  |
|---|--|
| Alarm time Acknowledg Message                     |  |
| * 9:37:26 AM 9:37:26 AM ABCDE FGHIJK LMNOPQ RSTUV | / WXYZ ABCDE FGHIJK LMNOPQ RSTUV WXYZ          |
|   |  |
| ACKNOWLEDGE CLEAR ALL                             |  |
|   | Operating status                               |
| PENDANT PRESS OPERATION<br>SETROINT MEASURED      | Local Message Display                          |
| PUNCH LAST CYCLE                                  | Unitical alarms                                |
| FORCE (tons) NNN NNN NNN                          | Urgent alarms                                  |
| POSITION (ins) NN.NNN NN.NNN NN.NNN               | Local Message Display                          |
| HOLD DOWN   | Current part name                              |
| FORCE (tons) NNN NNN                              | SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS         |
| POSITION (ins) NN.NNN                             | AUTO TOOL NOT LOCKPINS<br>REFERENCED MIDTRAVEL |

Although scrolling alarms are shown on the local message displays on the lower right hand side of the base display, this information is transitory in nature. Once the alarm is acknowledged all information displayed at this location will disappear. The alarm history will maintain a record of the last 128 alarms. Various controls and are provided to acknowledge, silence, clear and scroll through the alarm history.



### **CLEAN SCREEN**



Touch displays need to be cleaned form time to time. This should be done either when the display is shut down or on a display that has no active fields. The only part of the display that is active is the upper right corner of the display that is used to exit the display. The display has purposely been configured to be slow to react so as to prevent the display from switching while cleaning.



## LINEAR TRANSDUCER SET UP



Use this utility to setup the linear transducer in the event it has to be replaced.

Remove all tooling allowing the punch and holdown to be moved to the limits of the cylinder. For each axis move to the uppermost position, enable calibration and press the REFERENCE TOP button; similarly move the axis to lowest position, enable calibration and press the REFERENCE BOTTOM button.

In each position the PLC program will snapshot the signal from the transducer at each position and correlate it to previously measured top and bottom positions.



## **SECURITY**



- The HMI is configured with several security access levels limiting operator access to specific areas of a display or to entire displays. This window provides a method for the user to log in and log out. The system will log out automatically after 30-minutes .
- When a user logs in for the first time, the system will immediately require the password to be changed. The user names and initial passwords are as follows:

| User name   | Initial password |  |
|-------------|------------------|--|
| Default     | none             |  |
| Maintenance | 1101             |  |
| Supervisor  | 2202             |  |
| Macrodyne   | Please call      |  |
| -           | Macrodyne        |  |

A system exit button is provided on this display that allows the user to access the core functions of the HMI display. It may be necessary to access these features to adjust date and time if necessary.



# **CONTROL STATION SELECT**



The motion of the punch and holdown can be controlled from three different locations. From a safety viewpoint only one can be active at any time. This allows the operator to select the active station.



### 4. <u>Hydraulics</u>

### WARNING

It is critical to the operation and longevity of the press and hydraulic systems that oil cleanliness is maintained. Always replace filters when plugged filter switch indicators show that this is necessary. Do not operate the power units with filters removed. Only use replacement filters approved by Macrodyne.

Hydraulic components including pumps, valves and cylinders that have been damaged as a result of contamination will not be covered by warranty.

#### 4.1 <u>Hydraulic Power Unit</u>

The press is equipped with a hydraulic power unit that is comprised of the following:

- Oil reservoir
- One (1) main hydraulic pump motor group
- Cooling filtration system
- Punch manifold assembly
- Hold-Down manifold assembly
- Piping and tubing

This equipment is described on Appendix 3 & 4 in this manual

#### 4.2 Oil reservoir

The reservoir is a steel fabrication that is suitably segmented and baffled. In general hot oil from the press is returned to a segregated part of the reservoir. This oil is pumped through the kidney loop system where it is cooled, filtered and returned to a separate section of the reservoir. The cool filtered oil is then directed to the main pump suction. The reservoir is equipped with all necessary piping, flanges and connection that are required. The reservoir has a nominal capacity of 300 gallons (1100 l).

#### WARNING

When filling or topping up the oil reservoir always ensure that the new oil is filtered through a 5-micron filter.



The reservoir is also equipped with air breathers to ensure that the tank is not pressurized as oil is moved in and out of the reservoir. The breathers have replaceable filter elements that need to be maintained on a regular basis.

### **WARNING**

It is critical that all filter elements are properly maintained and replaced on a regular basis. Do not operate the press with the breather filters removed as this will result in oil contamination.

The reservoir is also equipped with the following instruments:

- Level gages (sight glass type)
- Level switches
- Oil temperature transducer



(Picture of Hydraulic power unit)

### 4.3 Pump motor groups

The pump motor group consists of: -1 (one) 65 GPM Parker, pressure compensated, variable displacement, piston pump, and 1(one) 7.5 GPM Parker, pressure compensated, variable displacement, piston pump, driven by a 200-HP electric motor operating at 1,800 RPM.



### 4.4 <u>Cooling/filtration system</u>

The cooling filtration system conditions the oil, ensuring the oil temperature is within a suitable operating range and is properly filtered. The system includes the following components:

- One (1) Vane pump
- One (1) oil/water Tube and Shell type heat exchangers
- One (1) recirculation filter
- One (1) solenoid water valve
- One (1) in-line check valve

The kidney-loop (cooling/filtration) system will operate continuously while the press is in operation.

Oil temperature is monitored by means of a temperature transmitter mounted on the oil reservoir. Normal operating oil temperature is 90-120 degrees F. A high oil temperature warning is posted at 130 degrees; the press stop will be tripped at 135-degrees. Above 137 degrees the motors will be stopped

#### 4.5 Punch manifold

The valves for operation of the punch cylinder are mounted to a custom manifold, mounted on the reservoir, as shown on the hydraulic schematic.



(Picture of Punch Manifold)



### 4.6 Hold-Down Manifold

A second custom manifold contains all the valving required for the hold-down cylinders, and is also mounted on the reservoir.



(Picture of Hold-Down manifold)



#### 5. Spare Parts

This section contains a list of the spare parts recommended for the equipment supplied. Due to the complexity and diversity of the technologies employed in our equipment, it is not possible for Macrodyne to stock replacement parts for every machine we manufacture.

Many components have exceptionally long lead times and we strongly advise that the owner maintain an inventory of spare parts. Doing so can help avoid any lengthy downtime resulting from long lead times associated with more complex components, particularly hydraulic pumps and valves.

The attached list includes a spare parts risk assessment and approximate delivery times for the items at the time of printing. A critical spare is defined as any item with a lead-time in excess of two weeks and/or is required for the equipment to function.

The owner must assess the adequacy of these lists. In preparing these lists, both the type of equipment and the type of service have been considered, but without specific knowledge of the owner's calibre of maintenance procedures or personnel.

This spare parts list is provided as a suggestion only and without liability or responsibility on the part of Macrodyne Technologies either as to the quantity listed or as to any items that may not be included for whatever reason.

Refer to Appendix 7 for Spare Parts List.



### 6. Long Term Storage

It may be necessary to store the equipment or take it out of service for periods in excess of two months. This includes:

- storage prior to installation.
- the time between installation and commissioning.
- idle time prior to and during major refits, shutdowns or rebuilding programs

During these periods, the following recommendations are the minimum for adequate protection and to maintain serviceability. Once every three months during the storage period, visually inspect all the equipment for oil leaks, damage, rusting of parts, and deterioration of protective covers and coatings. Check the level of protective oil in hydraulic systems and gearboxes, etc. Rectify any problems immediately. At the time of these inspections, turn over the electric motors by hand to avoid damage to the bearings due to vibration. If motors or junction boxes have been supplied with anti-condensation heaters and, during storage or shut down, they will be located where they will be subject to atmospheric conditions similar to those experienced in service, supply power to operate the heaters.

#### **Protection and Lubrication**

Coat all exposed metal and unpainted surfaces, including threads, sliding ways, etc., with a suitable industrial rust preventative material such as those listed below or their equivalent. Where the equipment has been coated prior to shipment, touch up any areas where the coating has been scratched or scraped off.

Suitable rust preventive materials:

- Shell Ensis Fluids.
- Valvoline Tecty 506.

Inspect all blanks, covers and caps used to protect openings and piping connections during shipment. Make sure they are in good condition on arrival at the site. If not, replace or repair any damaged protectors immediately. Make sure exposed pipe threads are properly protected, not only from contaminants but also from physical damage. Make certain that all covers are properly fitted and intact, to prevent introduction of moisture and other contaminants. This is especially important where all construction work, concrete mixing, spray painting, sand or grit blasting will take place, on, or near, the equipment. Install proper dust tight blanks, covers, caps, or plugs on any piping, airways or openings disconnected. Unless otherwise instructed, cover any vents or openings normally open to the atmosphere during operation. This is especially important where construction work, concrete mixing, sprays painting, sand or grit blasting will take place. Clearly identify, colour code, mark or tag all covers, which must be removed prior to normal operation.



If wood is to be used for blocking on machined or unprotected surfaces for extended periods, provide a suitable vapour barrier between the wood and the metal surface to guard against acid corrosion. At the beginning of the storage period, with the exception of the hydraulic system, lubricate the equipment according to the normal lubrication instructions. For hydraulic systems, follow the special instructions provided later in this section. Depending on the circumstances and the environmental conditions, some components may require inspection and periodic lubrication throughout the storage period, but at three to six months, rather than at normal operating intervals.

Where possible, in taking equipment out of service, pump grease into the grease fittings until the grease discharged from the bearing or bearing surfaces appears to be clean. However, be careful not to place certain ball or roller bearings back in service with too much grease in them, such that they exceed the normal operating temperature. If necessary, tag such bearings on storage to indicate "grease must be repacked to the proper level before returning to operation".

Where possible, store the equipment with any hydraulic cylinders in the "closed" or "piston rod retracted" protected by the rod clamp position. If not, keep the exposed length of all hydraulic cylinder rods coated with light grease. Inspect the equipment for any possible damage caused by slinging or handling. Repair painted surfaces.

Using an appropriate touch up procedure is particularly important where original paint specifications include a two-part inorganic zinc prime coat. Duplicating the original specifications requires proper preparation and application procedures. You should only do this under carefully controlled conditions. Otherwise, contact Macrodyne Technologies for a suitable alternate procedure.

### **Hydraulics**

Drain the Hydraulic Power Unit tanks of hydraulic fluid, and then fill the tank to a depth of 50 mm (2 inches) with protective oil. Appropriate protective oil for this purpose is Shell VSI Circulating Oil 100, or its equivalent. When any hydraulic tank is drained for storage, Macrodyne suggests that the tank be tagged "NOT OPERATIONAL - DRAIN AND REFILL WITH CORRECT HYDRAULIC FLUID BEFORE OPERATING". Leave hydraulic fluid in all pumps, manifolds, valves, cylinders and interconnecting piping. Cap or plug any disconnected piping and ensure any exposed threads are protected.

Once every three months, check the protective oil level and replenish it if required. Ensure grease is intact on exposed cylinder rods.



### Long-Term Storage of Cylinders/Ejectors

In preparing cylinders/ejectors for long-term storage it is preferable to fill the cylinders/ejectors with oil to prevent rust. In completing the previous there is a concern that thermal cycling due to seasonal changes may generate high pressures within the cylinder/ejectors.

- Always store fully retracted.
- Store indoors in a clean, dry area.
- Smear the internal surfaces of eye/clevis bushings or bearings with grease, particularly if they're steel.
- Protect any exposed chrome on the rod. Oil-impregnated tape such as Denso tape can be used for this purpose. Before applying, make sure the rod is fully retracted. If a product like Denso tape is applied to the rod when the rod is not fully retracted, subsequent retraction of the rod can result in damage to the rod seal.
- Plug the service ports with steel, not plastic, plugs or blanking plates equipped with test ports.
- Fill the cylinder with clean hydraulic oil. For single acting cylinders add oil to the bore end, but do not fill, to eliminate pressure intensification; for double acting cylinders fill the rod end and add oil to the bore end, without filling completely, to eliminate pressure intensification.
- Attach appropriate warning tags to BOTH service ports indicating that the cylinders may be under pressure.
- It is important to regularly monitor the cylinders by plugging in test gages. If there is an excessive pressure buildup then bleed and vent the cylinder.
- Before removing a blanking plate, vent the cylinder first

### **Close Fits**

Installation of some equipment parts requires that close fits, such as force fits or shrink fits, be made in the field. When storing such parts prior to assembly, it is very important to handle and protect the machined surfaces involved, carefully. Burrs, scratches, oxidation and contamination can cause difficulties and complications at assembly. To avoid difficulties, ensure surfaces are completely coated with a suitable rust preventive material. Support the equipment properly. Store it in a location where it will not be damaged by coming in contact with other pieces of equipment or by having other items placed on top of it



### **Frames**

The frames of Macrodyne Technologies equipment are designed, normally, to be placed on proper foundations and/or adequately supported at installation. This constrains the frames in their correct alignment during operation. When storing equipment, support the frames properly, on sufficient bearing surfaces of adequate size. Ensure the frames are aligned and not unduly stressed or distorted.

### **Electrical Equipment and Enclosures**

During storage, support any consoles, electrical cabinets or enclosures clear of the ground. The height must be sufficient to prevent entry of water through mounting holes and other openings. To avoid breakage, protect and/or cover all items made of glass, such as switches, pilot lights, gauges, windows, etc. Always replace any broken glass with the correct type. Keep doors closed throughout the storage period. Indoor storage in a clean, dry, heated location is best. Even in such indoor locations, cover consoles, cabinets and enclosures to limit exposure to dust and dirt.

Inspect the unit monthly. Ensure that electrical equipment, within enclosures, is not subjected to unnecessary dampness. If anti-condensation heaters are supplied, it may be necessary to provide electrical power to the heaters to prevent moisture from condensing in the interior. When storing outdoors, and heaters or heater power is not available, place a desiccant inside all cabinets or enclosures. Store all the equipment within sealed, waterproof coverings or containers. Inspect each covering or container monthly to check for any damage. Inspect the contents every six months.