Global Pneumatic System : mike s / March 12, 2001

A functional description of how devices shown in print #62-95003-4 for Global C&D interact

( not an official document --- intended to be service and training help text only )

**Electro-Pneumatic chain of events during power up / operating air flowing to machine:**

Machine controller must be switched -on- for 24 Volts DC to supply solenoid and electric pressure switches.

-Compressed air from the shop’s supply flows through filter 1 and 2 to regulator with gage where the operating pressure is set to 4 bar ( 58 psi).

-Filtered, yet unregulated air is piped from a DIVERTER ( junction only, does not contain any tricks ) unit, located between air filters and regulator/gage, up to the Z counterbalance regulator, mounted at the + end of the X guide way. This regulator is set to supply the counterbalance cylinder with sufficient pressure to pneumatically hold the rail at equilibrium when Z air bearing set gets energized and the rail becomes free-floating counter balance pressure depends on machine’s Z size; to set the regulator: find correct balance pressure by using technique described in switch settings and adjustment procedures ( page 2 )

-Counterbalance pressure builds up rapidly on -power up- as the rail must be balanced before all air bearing sets are supplied.

- This prevents the Z rail from drifting down or up when its air bearings are being supplied and lift.

When air pressure in counterbalance cylinder has built up to equilibrium value, electric pressure switch PCC, connected with a feedback air line directly to the counterbalance regulator, senses it and closes its N/O contacts 1 and 3 sends signal PCC to machine controller (see G550480661 page 9 for signal processing) sends signal to solenoid allowing it to OPEN.

As the solenoid OPENS air flows to all bearing manifolds on the machine and to electric pressure switch PAP.electric pressure switch PAP closes its N/O contacts 1 and 3 sends signal PAPAT to machine controller (see G550480661 page 9 for signal processing)

All bearing sets are piped in series, with the Z manifold last in line to theoretically introduce the longest delay in supplying the Z air bearing set with lift yet another margin of safety against unwanted Z movement, X and Y air bearings are being supplied, Z bearings release the now balanced Z rail, - machine floats - Z rail - is balanced at equilibrium, held in position by balanced forces and the drag of its attached drive system.

PAP senses air pressure from two directions, the supply side via the opened solenoid and from the air circulating through the machine’s piping and air bearings.

- It must sense a minimum of 55 psi maintained from the supply side via the open solenoid and must NOT sense any air pressure loss from the machine’s pneumatic system. If either one of these requirements is not fulfilled, loss of pressure on PAP’s membrane will open its electrical contacts which will set signal PAPAT to “not true”, causing an E-STOP.

PCC only senses air pressure in the Z rail’s counterbalance cylinder via the cylinders supply line and through a separate feedback line from the z rail regulator directly to PCC “c input” a rapid loss in pressure of about 5 psi in this pneumatic sub-system will cause PCC to open its contacts by virtue of reduced pressure on its membrane, which will set signal PCC to the controller to “not-true” and cause an E-STOP

- fast action is required to prevent damage and our devices react accordingly.

-in case of a slow leak causing loss of pressure in the counterbalance’s pneumatic circuit, drive belt friction will prevent unwanted Z rail drift until PCC senses the decrease of pressure and causes E-STOP.

**Notes:**PAP and PCC electric pressure switches are actuated by air pressure exerting force on their membrane which closes, or opens contacts in the electrical part of the switch, “reporting status” of switch and thus status of the machine’s air flow, to the machine controller via cables: WCA2 and WCA1 to a junction box in the Y loop ( XS2 and XS1 ) and cable XP7 to B3C LC receptacle XS7 on the MIX-O1R card.

The solenoid is actuated by voltage only (24V, DC) which it receives with signal EVG when PCC closes and in doing so completes the 24Vcuircuit to the solenoid; it is connected to the junction box-connector XS3 in the Y loop via cable WCA3. Override devices for the solenoid are not available (no more screws to turn in and keep the valve open , as practiced in the past)

Unregulated air is piped to the counterbalance system for a very good reason. Regulated 58 psi ( 4 bar ) air would generate only marginal lift to hold the Z rail mass of a D size Global at equilibrium when free floating ... unregulated air of the usual 70 psi + computes into plenty of lifting capacity.

Redundant-security is designed into our machine’s pneumatic system

-should by a catastrophic chain of events not yet experienced, the air supply to all bearing sets NOT be shut off nearly immediately by the solenoid, electric pressure switches PCC and PAP will still cause E-STOP, disallowing motor power and machine movement.

**Electric pressure switch settings and adjustment procedures :**

( copied from shop floor procedure 3/21/2000 )

Global machines have 2 pressure switches and a solenoid valve, located at the rear right hand corner of the machine, adjacent to the filter / regulator assembly. The purpose of this circuitry is to protect the Z rail from falling in the event of low counterbalance pressure, protect the air bearing system from low supply pressure, and to prevent “unexpected motion of Z” when supply pressure is introduced to the machine. Specifically, as pressure is initially introduced to the machine, normally open contacts on the counterbalance pressure switch, (PCC), close, allowing the solenoid to energize, which pressurizes the air bearing system. A second pressure switch, (PAP), is located downstream of the solenoid valve to protect the air bearing system in the event of low supply pressure. An open contact on either pressure switch will E-stop the machine.

PCC switch setting:

Tee in a pressure gage at the PCC switch. With the Z drive disconnected, balance the weight of the Z rail (add dummy probe weight) with the counterbalance regulator. Leave Z at its lowest position.

Record balance pressure.

Reduce pressure by 5 psi; adjust the pressure switch setting until the N.O. contacts are triggered to close. Test switch action by lowering the counterbalance pressure slowly until the contacts, open; then increase pressure slowly, noting the pressure when the contacts close again. Adjust the setting, if necessary, so that with increasing pressure, the contacts close 4 to 6 psi below the balance pressure. Lower pressure, slowly, until the contacts open. Record the pressure at which the contacts close.

Rebalance the Z rail, remove the gage, and reconnect the drive.

PAP switch setting:

Global machines run at 58 psi.

Lower supply pressure by 5 psi, then adjust the pressure switch so that the N.O. contacts just trigger to close. Test by reducing supply pressure to 50 psi, then slowly increase pressure until the contacts close. Adjust the setting, if necessary, to get the contacts to close between 52 and 54 psi. Finally, lower pressure, slowly, until the contacts open, and record both trigger pressures.

P3

**How to adjust electric pressure switch setting:**

tools needed:

multimeter

small flat screw driver

3mm hex driver

prepare as described above in adjustment procedure

1. Switch off machine controller
2. Remove rear section of pressure switch ( cable attached ) by turning out its center screw with screw driver
3. Remove threaded brass center from switch body with screw driver
4. Attach multimeter in “resistance-mode” to normally open contacts number 1 and 3 with alligator clips or
5. Other suitable fasteners
6. Assure that there is no accidental short circuit between contacts 1 and 3
7. Insert 3mm hex wrench through the opening generated by removing brass center and locate hex wrench tip into adjustment screw inside switch body..
8. Perform adjustment as described above
9. Switch is open when multimeter indicates indefinite ( a lot ) ohms resistance
10. Switch is closed when multimeter indicates zero ohms resistance
11. Sensitivity of electrical pressure switches has been advertised as being in the + /- 1 psi range.