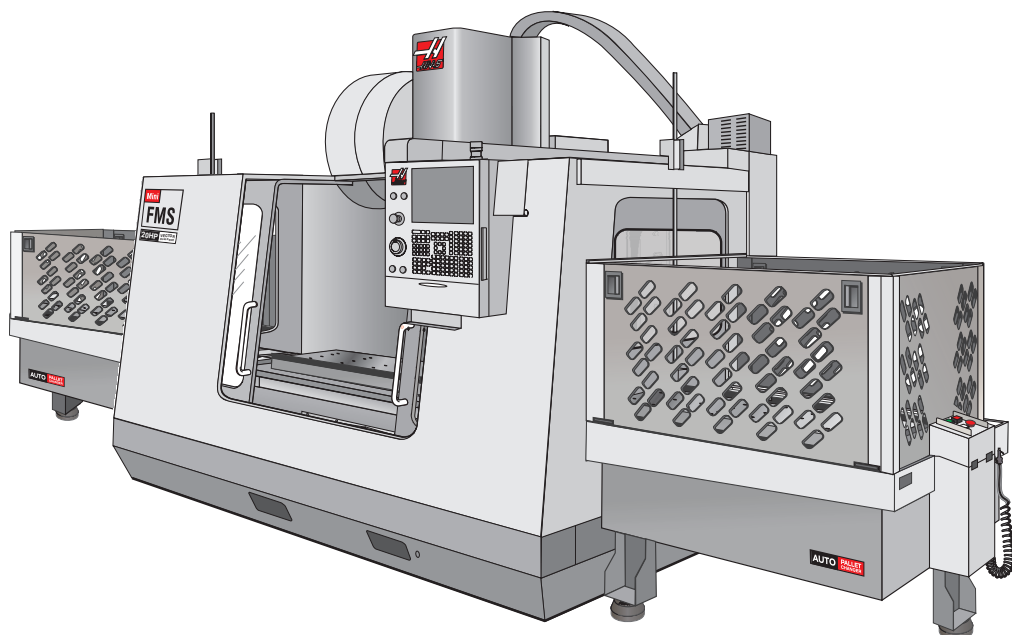


Automatic Pallet Changer Operator's Addendum





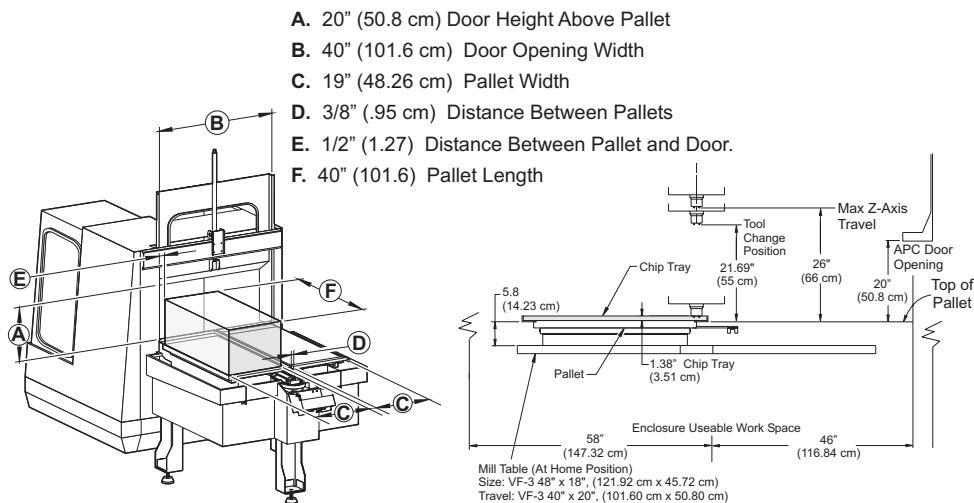
1.0 AUTOMATIC PALLET CHANGER (APC)

WARNING!

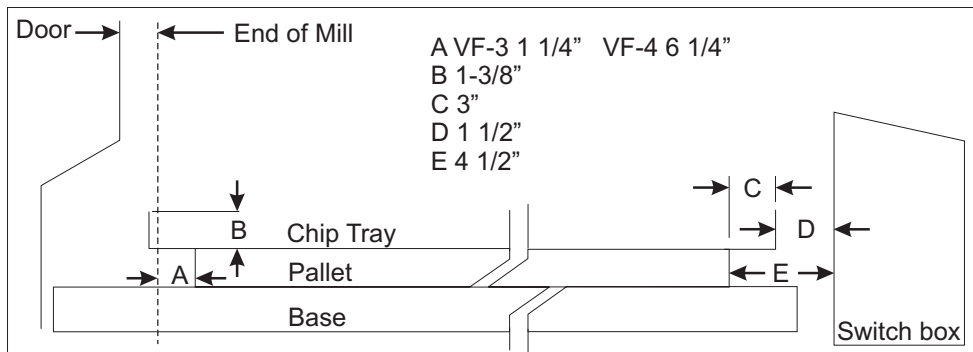
Read the entire addendum before attempting to install or operate the APC. Serious injury or damage could result from not following proper procedures.

This manual provides information on APC installation, programming and operation. This Operator's Manual is to be used in with the Haas Mill Operator's Manual.

1.2 APC WORKING DIMENSIONS



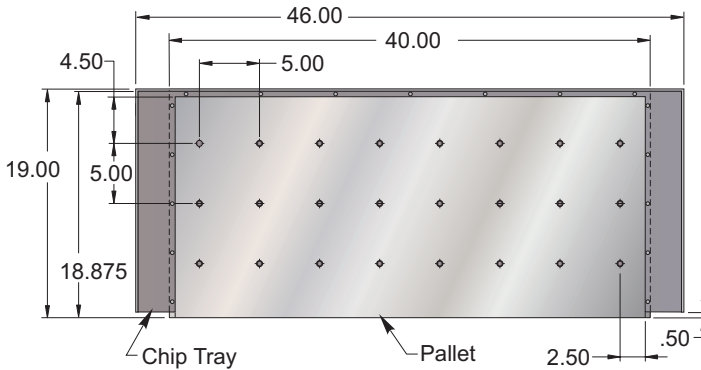
APC PALLET CLEARANCES





PALLET SPECIFICATIONS

Weight: 300 lbs. **Thickness:** 1 1/2" **Bolt Holes:** 5 inch spacing, 1/2"-13 X 3/4 DP threads **Holes drilled in pallet should be less than 1" deep.**



2.0 MAINTENANCE

The following is a list of required regular maintenance for the HAAS Automatic Pallet Changer. These specifications, **especially the daily routine maintenance**, must be followed in order to keep your machine in good working order and to protect your warranty.

Damage or misalignment may result from neglect of daily maintenance.

Daily Clean chips, coolant, and other debris from the APC and receiver areas. Pay special attention to the receiver clamping bars, and the pallet clamping rails and wipers. Clean chips and coolant from receiver pallet clamped switch. Apply a light coat of grease and work the grease into the plunger. Do not over grease.

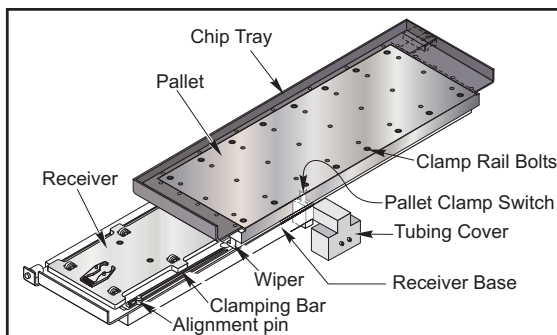
Clean the two locating pins in the receiver base and the corresponding bushings in the pallets. Apply a very light coat of general purpose grease to the pins and bushings, if needed.

Clean excessive chips and coolant from pallet drive chain.

Weekly Remove the two 1/4" screws from the control panel and rotate to open position. Clean chips and coolant from the drive sprocket and limit switch. Apply a light coat of general purpose grease and work the grease into the switch plungers. Check air gauge/regulator at the VMC lube/air panel for 85 psi.

Check condition of wipers. There are two wipers on each pallet.

Monthly Check door for proper operation. Clean and grease door side guide rails as required.



3.0 INSTALLATION

TOOLS REQUIRED:

- Machinists' level (2)
- 6' straightedge
- Allen wrenches
- Forklift capable of lifting 5,000 lbs, with forks at least 6' long
- Included - APC jumper
- Included - APC chain rotation tool (P/N 20-0102)

Prior to installing your VMC, make certain that there is enough floor space to place the APC.

The mill must be installed and leveled before installing the APC. Also make sure the APC jumper is installed in the "5th Axis" port on the side of the VMC control cabinet.

Remove the APC from its shipping crate. Remove all tie-downs and strapping materials. Remove the pallet shipping bolts and install the socket set screw plugs with Loctite. Lift off the pallets and set them aside. **CAUTION!** The pallets have wipers on the bottom of the clamp rails at the VMC end - Do not allow the weight of the pallet to rest on these wiper. Remove the door air cylinder and the cable bundle from their storage positions in the APC pan.



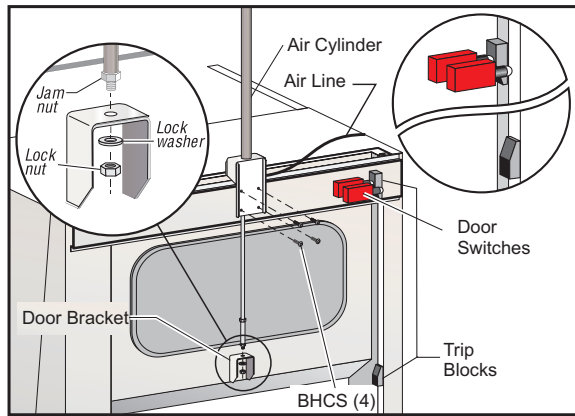
3.1 ASSEMBLY, ROUGH LEVELING AND ALIGNMENT

1. Remove the lock nut and washer from the end of the air cylinder rod. Connect the air cylinder and bracket to the machine with four 1/4"-20 BHCS.

2. Insert the air cylinder rod into the door bracket, then attach the lock nut and washer to the bottom of the cylinder rod.

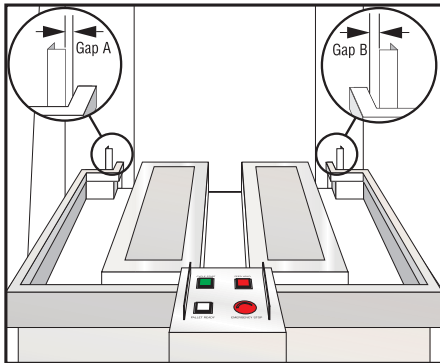
3. Install the door switches and bracket to the VMC.

Insert the door air line into the fitting at the base of the air cylinder.

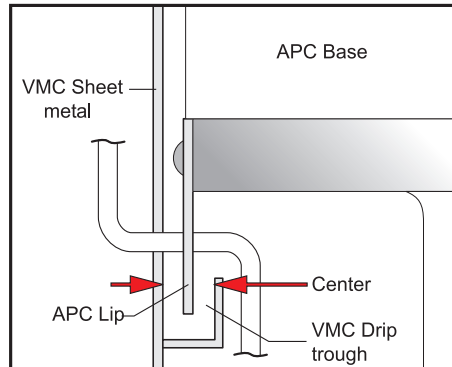


4. Power On the VMC and Zero Return all axes. Verify that the VMC operates normally. In MDI mode, command an M17. The table will unclamp and raise up from the receiver, and the automatic door will open. Clean all shipping protectant from the rollers, alignment pins and clamp bars.

5. Lift the APC (with the forklift) and install the leveling screws into the legs. Set the APC in place on the leveling pads. Ensure that the lip of the APC enclosure is centered in the VMC drip trough and that the copper air tubes are not damaged.

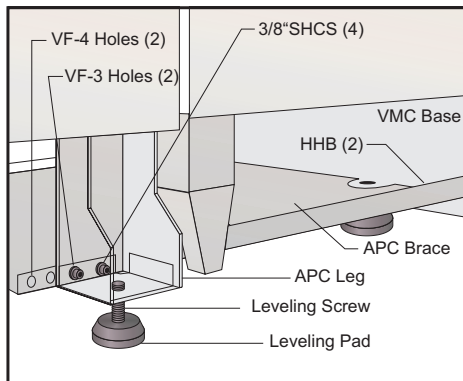


APC Centered in the VMC Door Opening

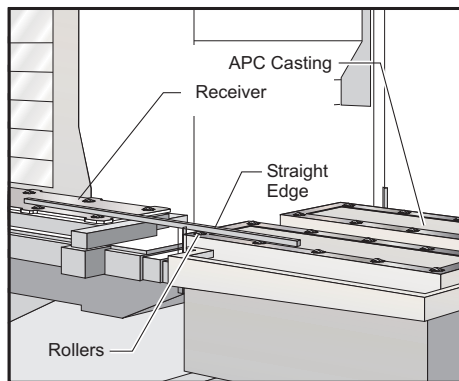


APC lip centered in the VMC drip trough.

6. Attach the APC brace between the mill and the APC (four 3/8" screws in the APC legs and two 1" screws in the VMC base), but DO NOT TIGHTEN.



Installing the APC Brace



APC Roller Alignment Setup

7. In MDI mode, command an M14. The table will move to the pallet #1 load position. (The front right corner of the VMC).

8. Place the straightedge on top of the rollers of both the VMC receiver (unclamped) and the APC, to check the APC height. Make sure that the straight-edge is on top of at least two rollers on both the unclamped receiver and the APC in order to get an accurate reading. Adjust the leveling screws in the APC legs until the straightedge lays completely flat on all rollers.

9. Place the straightedge against the side of the rollers on the VMC receiver and the APC, to ensure that the rollers are aligned in the Y-axis of the mill. The straightedge must extend past at least two rollers on both the APC and VMC to get an accurate reading.

If the rollers are not parallel, the APC must be moved. The APC can be moved slightly by tapping on the leveling pads with a hammer. If the rollers are parallel, but are not aligned, the adjustments will be made later in the “Fine Tuning” section.

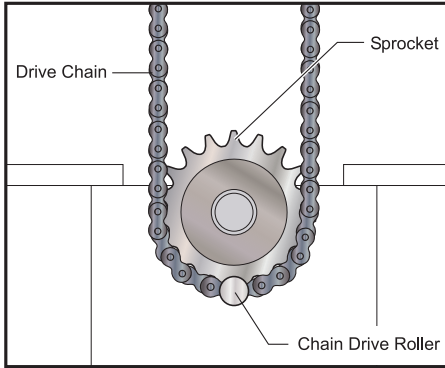
10. In MDI mode, command an M15. The table will move to the pallet #2 load position (right rear corner of the VMC). Repeat Steps 8 and 9 with the table in this position.

11. Tighten down the four 3/8 SHCS and two hex-head bolts on the APC brace evenly, so the APC is not pulled out of alignment. Recheck the level and all alignments.

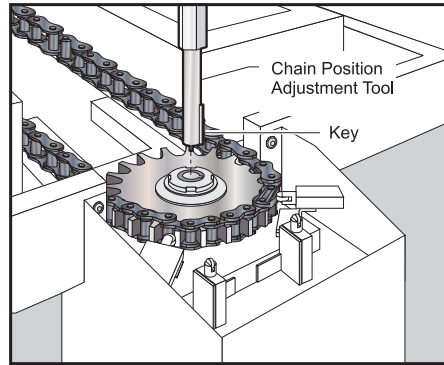
Setting up the APC

12. Open the hinged APC operator's panel cover by removing the two BHCS.

13. Ensure that the drive roller on the APC chain is centered under the control box as shown. If not, use the chain position adjustment tool to rotate it into this position. To use this tool, place it into the center of the drive sprocket with the key in the sprocket's keyway. Push down and turn the tool with a wrench in order to position the chain.



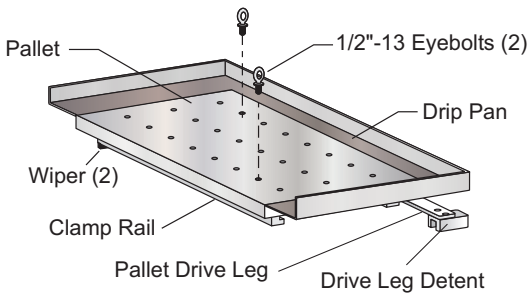
Chain drive roller positioning



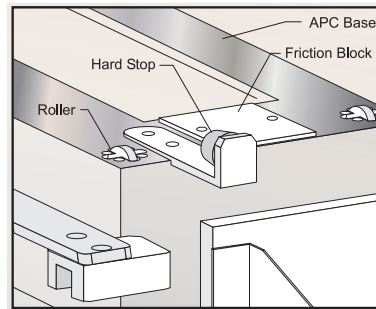
Chain position adjustment tool placement

14. Insert two 1/2"-13 eyebolts into each pallet. Attach straps or chains to the eyebolts, and use a forklift or hoist to lift each of the pallets onto the APC. Ensure that each pallet is placed with its drive leg pawl under the APC operator's panel, and that the APC rollers fit into the grooves on the bottom of the pallets.

NOTE: Be careful not to set the pallets on top of the chain drive roller. If necessary, rotate the chain slightly using the chain position adjustment tool. Be careful not to damage the pallets or the APC rollers.



Lifting eyebolt locations



APC base with friction block and hard stop

15. Pull the pallets onto the friction blocks and against the hard stop. Rotate the chain slightly, using the chain position adjustment tool, to allow each drive leg detent to clear the chain drive roller. Power Off the VMC.

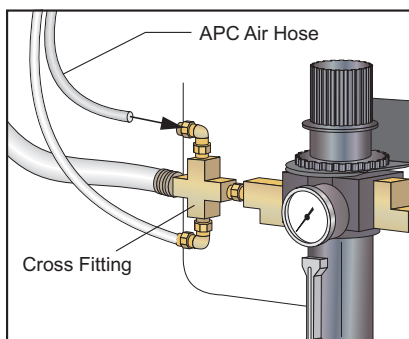
WARNING!

This will cause the automatic door to close. Keep hands clear.

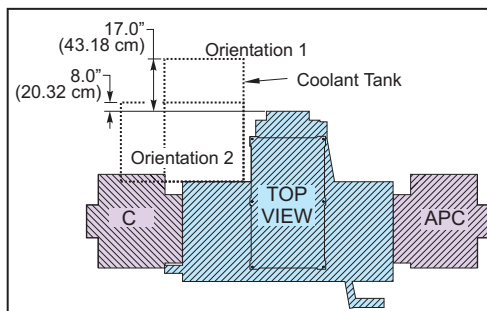
16. Remove the jumper from the Fifth Axis (B) port on the side of the VMC control cabinet, and connect the APC amphenol to this port. Tie-wrap the cable to the door switch cable and the air hoses at the rear of the VMC.



17. Screw the air blast hose into the APC. Remove the piece of tubing from the top fitting of the VMC lube/air panel cross fitting, and replace it with the APC air hose. Connect the air supply for pallet rail air blast.



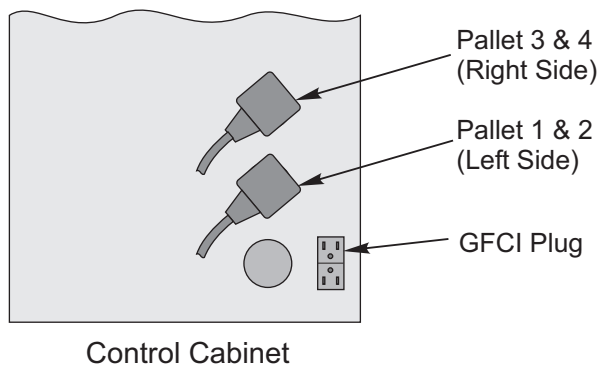
APC air hose to VMC air/lube cross fitting



Coolant Tank Placement (Quad APC Shown)

18. Position the coolant tank.

19. Connect the pallet changers to the side of the control cabinet as shown:



Control Cabinet



3.2 FINE TUNING

The APC was set up, run, and adjusted at the factory. Due to slight variations during reassembly, it will be necessary to fine tune the APC to ensure that the pallets load and unload as smoothly as possible.

SETTINGS

The following settings control the location of the mill table during pallet changes. Fine-tuning consists of adjusting settings 121-129, and settings 146-154, and the height of the APCs. For instance, 121 controls the X-axis position that the mill table will move to in order to load pallet 1. If the receiver does not clamp the pallet due to misalignment of the locating pins and the pallet bushings, this value can be changed to move the receiver closer to or farther from the APC. The drive pin on the chain should drop the pallet directly over the locating pins. Similarly, if the pallet is misaligned in the Y-axis, causing the pallet to shift to one side during loading and unloading, variable 122 can be modified.

The following settings can be modified to adjust the table location for loading and unloading of pallets:

121 APC PAL. 1 LOAD X = Pallet 1 load X position
122 APC PAL. 1 LOAD Y = Pallet 1 load Y position
123 APC PAL. 1 UNLOAD X = Pallet 1 unload X position
124 APC PAL. 1 UNLOAD Y = Pallet 1 unload Y position
125 APC PAL. 2 LOAD X = Pallet 2 load X position
126 APC PAL. 2 LOAD Y = Pallet 2 load Y position
127 APC PAL. 2 UNLOAD X = Pallet 2 unload X position
128 APC PAL. 2 UNLOAD Y = Pallet 2 unload Y position
129 APC PAL. 1 AND 2 SAFE X = For clearance of pallets 1 and 2 drive legs from right APC door
146 APC PAL. 3 LOAD X = Pallet 3 load X position
147 APC PAL. 3 LOAD Y = Pallet 3 load Y position
148 APC PAL. 3 UNLOAD X = Pallet 3 unload X position
149 APC PAL. 3 UNLOAD Y = Pallet 3 unload Y position
150 APC PAL. 4 LOAD X = Pallet 4 load X position
151 APC PAL. 4 LOAD Y = Pallet 4 load Y position
152 APC PAL. 4 UNLOAD X = Pallet 4 unload X position
153 APC PAL. 4 UNLOAD Y = Pallet 4 unload Y position
154 APC PAL. 3 AND 4 SAFE X = For clearance of pallets 3 and 4 drive legs from left APC door

To unload a pallet without loading another pallet, run M90 or M50 P0.

To modify a setting value, press the SETNG/GRAPH button, enter the setting number and press the down arrow to jump to that setting. Enter a new value and press Write/Enter.



1. Power On the mill. In MDI mode, command an M17, then an M14, to position the mill table. M14 will align the receiver with Pallet #1. M15 will align the receiver with Pallet #2.
2. Manually push the pallet adjacent to the receiver from the APC to the receiver. If necessary, use the chain position adjustment tool to rotate the chain until the chain drive roller clears the drive leg.
3. Push the pallet between the receiver and the APC a number of times. As the pallet goes over the receiver rollers, note if the Y or Z-axis (height) is out of alignment.

If the alignment is incorrect in the Y-axis, handle jog the table in the Y-axis (in increments of .001) until pallet loading and unloading is smooth. Record the final Y-axis position in settings 122 and 124. These two settings should be set to the same value initially, and may be adjusted separately later if either loading or unloading is not smooth.

If alignment is incorrect in the Z-axis (height), adjust it by turning the leveling screws until pallet loading and unloading is smooth.
4. Push the pallet back onto the APC. In MDI mode, command an M15 to move the pallet to load position #2. Repeat the previous steps for pallet #2.
5. In MDI mode, command an M18 to clamp the pallet and close the APC door. The message "PEND MOVE (Y)" will appear and motion will stop during an M18. Press "Y" to continue motion.

WARNING

If a pallet change sequence is stopped for any reason (e.g. E-Stop, power outage, or low air supply), both the pallet and chain locations must be checked before operating the mill. See the Pallet Changer Recovery section.

DO NOT attempt to operate the VMC until the pallet drive arm is disengaged from the pallet drive pin on the chain.

6. Enter a program in MDI that consists of an M36 (flash "Schedule Pallet" light), an M50 (pallet change), and an M99 (repeat). Press Cycle Start and the Schedule Pallet light will flash.
7. Press Schedule Pallet, and the pallet will start to load. Press Feed Hold as soon as the chain starts to move. This will cause the pallet to load, but not clamp.

When the pallet has stopped, the bushing in the bottom of the pallet should be directly over the locating pin in the receiver (within +/- .09). If the pin and bushing are not aligned, change the load position of the receiver.



If the pallet makes a noise as it stops, the locating stub on the bottom of the pallet hit the locating fingers on the Pallet Clamp Plate. Change the value of the X Load Position by adjusting setting 121 for pallet 1, and setting 125 for pallet 2. Typically the load and unload positions will be the same for both pallets.

Nudge the pallet to align the pin and bushing then press Cycle Start. The pallet should clamp.

Repeat the X-axis alignment process until the pin and bushing are aligned.

A perfectly aligned pallet will move straight up and down as it clamp and un-clamps. Pallets using some of the tolerance will settle left or right when moving up and down with the clamping action. This settling does not affect the final alignment of the pallets. The pallet position tolerance is ± 0.0005 .

8. To confirm the correct X-axis pallet load positions, run the program that consists of an M36, M50, and M99 again. Note any places that the process does not run smoothly, press Feed Hold, and change one of the settings to adjust this misalignment.

NOTE: Make sure to confirm the alignment at both pallet load positions. After confirmation, the settings should be written down or saved to disk.

Load a pallet with fixturing and parts and verify receiver movement is correct. Receiver must lift pallet to correct height and remain level. Insufficient air supply and/or heavy loads may slow down receiver lifting. Increase air supply or increase the parameter 317 value from 4000 to 5000 or 6000 if necessary. In extreme cases the Pallet Rail Air Blast can be disabled by unplugging the power cable to the solenoid valve on the APC base leg. Tie the up in a safe location away from anything that may short across the plug.

4.0 PROGRAMMING

Heavy loads (over 250 lbs) should be distributed evenly around the center of the pallet to avoid tipping the pallet during loading and unloading.

NOTE: The Pallet Rail Air Blast consumes significant air volume and will effect the ability to change pallets if compressor or hose size is too small.

4.1 PROGRAM COMMANDS

The APC is controlled by a program in CNC memory. M codes are used in the parts program to control the APC. The pallet change routine is run by using an M50 code in the parts program. In order for M50 to work the APC load and unload coordinate must be set (settings 121-128 and 146-153). Make sure that the X coordinate safe distance, setting 129 and 154, is set to -33.000.



The APC can be programmed to run one program on both pallets, or a different program on each pallet. The “Sample Programs” section consists of two basic programs: the first sample program runs the same part on both pallets, and the second program runs a different part on each pallet.

The APC has its own operator’s panel, which includes Cycle Start, Feed Hold, and Emergency Stop buttons that perform the same functions as those on the VMC control panel. This panel also includes a Schedule Pallet button, which is used for APC functions.

If the Schedule Pallet key has not been pressed, the APC will flash the “Schedule Pallet” light at the completion of the user’s part program, and wait until the Schedule Pallet button has been pressed before performing the pallet change. This feature prevents a pallet change from occurring before the operator is ready. The Schedule Pallet button can be pressed at any time and will be recognized when the next program is finished and a pallet change is required.

Important! If alignment adjustments are necessary during operation, refer to the “Installation” section and modify the appropriate settings.

PROGRAMMING FOR FMS

Using an M50 code in the parts program runs the pallet change routine. In order for M50 to work correctly the APC load and unload coordinate must be set for each pallet (settings 121 through 128 and 146-153. Make sure that the X coordinate safe distances are set correctly. See Table for correct X coordinate safe distances.

Safe Distance Settings Table

	<u>Pallets 1 & 2</u> Setting 129 (inches)	<u>Pallets 3 & 4</u> Setting 146 (inches)
VF-3	-33.000	-7.00
VF-4	-43.000	-7.00

The APC can be programmed to run the same parts program on all pallets, or a different program on each pallet. See “Sample Programs” for some of the options available for pallet change programming.

For the Dual APC to perform automatic pallet sequencing and part program selection, each pallet must be “scheduled” and must have a parts program assigned to it. Scheduling is done in two ways. A pallet can be scheduled with its Schedule Pallet button on the operator’s panel. Pushing the button schedules the pallets in the sequence they are pushed.



The pallets can also be scheduled from the Pallet Schedule Table (PST) display. This display can be found by pressing the CURNT COMDS key and then pressing the PAGE UP or PAGE DOWN keys until the Pallet Schedule Table page is reached. The pallets can be scheduled from this display by using the arrow keys to highlight the "Load Order" box for the pallet. With the cursor in the correct box, enter a number 1,2,3, or 4 by keying the number and then the WRITE key. If there is already a priority number for that pallet, the "Load Order" numbers of the other pallets will be updated as necessary. A pallet that is in the receiver will have an asterisk in the "Load Order" column.

The home position for each pallet is as follows: Pallet 1, to the right and closest to the control pendant. Pallet 2, to the right and furthest from the control pendant. Pallet 3, to the left and furthest from the control pendant. Pallet 4 to the left and closest to the control pendant.

As mentioned above, a pallet must have a part program assigned to it. Assigning a part program is also done in the PST display. The arrow keys are used to highlight the "Program Number" box for the pallet. The program number is entered by keying the number and then pressing the WRITE key. For example, keying **O123**, then **WRITE** will put the program number O00123 into the table.

If a parts program encounters an M50 (without a P code) and none of the SCHEDULE PALLET buttons have been pressed, the VMC control will pause operation, the beacon will blink green, and the message "NONE SCHEDULED" will appear on the screen. The VMC will wait until a Schedule Pallet button has been pressed, or the PST has been updated, before performing the pallet change. This feature prevents a pallet change from occurring before the operator is ready. The Schedule Pallet button can be pressed at any time and will be recognized when the next pallet change is required.

Pallets can also be changed without automatic sequencing or PST inputs. This is done using M50 with a P code. M50 P1 will load pallet #1 without checking to see if it is scheduled. M36 P1 before the M50 P1 will check that pallet #1 is ready. If the Schedule Pallet button has been pressed, the pallet #1 will be loaded. If the Schedule Pallet button for pallet #1 has not been pressed, the indicator light on the button will flash and the VMC control will flash "SCHEDULE PAL#1".

There are 30 different pallet status values to use. The first four: UNSCHEDULED, SCHEDULED, LOADED, and COMPLETED, are fixed and cannot be changed. The remaining 26 can be modified and used as needed.



Changing or adding status text can be done in the PST. Use the arrow keys to move the table cursor to the “PALLET STATUS” column. Press the F1 key. A selection menu will appear over the “PALLET STATUS” column. (Pressing F1 again or RESET will close the menu.) The number to the left of the text is the status number. This number can be used with the M49 command to set the status from the part program. The items in the menu can be selected with the UP and DOWN arrow keys, or the handle jog dial. Change the text by pressing the letter keys then F3. change as many status items as desired. Note: all pallets use the same list of status items. Pressing F1 closes the menu without changing the status of any of the pallets.

Resetting a status item to USER is done by selecting an item from the menu and selecting F4. All status items can be reset at the same time with the ORIGIN key.

Changing the status of an individual pallet can be done from the PST or with the M49 command. In the PST, move the table cursor to the “PALLET STATUS” column for the pallet desired. Press F1 for the status item menu. Use the arrow keys to move to the correct status. Press F2 or WRITE. The menu will vanish and the pallet status will be changed (some restrictions apply). See the description of the M49 command and the following examples for setting the pallet status from a program.

System macro variables are available. Note that these are read only, except for Pallet Priority and Status, which can be written to when pallets are unloaded.

#3028 Number of pallet loaded on receiver	#7701-#7704 Program number assigned to pallet
#7501-#7504 Pallet Priority	#7801-#7804 Pallet usage count
#7601-#7604 Pallet Status	

4.2 M CODES

The following **M** codes are specifically used to program the APC:
Only one **M** code may be programmed per block of a program.

M14 Move APC table to pallet 1 load position

M15 Move APC table to pallet 2 load position

Using M14 and M15 on the Quad APC requires a P-code. M14 sends the receiver to pallet unload positions, M15 sends the receiver to the pallet load positions, based on the pallet number specified by the P code and settings 122-128 and 146-153.

M36 Flash “Schedule Pallet” Light

For the dual pallet APC, M36 is placed before M50 in the G-code program to check that the next pallet is ready to load. When the Schedule Pallet button on the operator’s panel is pushed, the pallet change proceeds. On the Quad APC, M36 requires a P-code to specify which pallet should be checked for readiness. If other pallets are scheduled at a higher priority, the operator will be prompted to unschedule them.



M46 Jump If Pallet Loaded

This M code causes control to be transferred to the line number specified by the P code if the pallet specified by the Q code is currently loaded.

Example: M46Qn Pnn Jump to line nn in the current program if pallet n is loaded, otherwise go to the next block.

M48 Check Validity of Current Program

This M code generates alarm 909 if the current program is not listed in the Pallet Schedule Table. It generates alarm 910 if the pallet that is currently loaded is not listed in the Pallet Schedule Table for the current program.

M49 Set Status of Pallet

This M code sets that status of the pallet specified by the P code to the value specified by the Q code. The possible Q codes are 0-Unscheduled 1-Scheduled 2-Loaded 3-Completed 4 through 29 are user definable. The pallet status is for display purposes only. The control does not depend upon it being any particular value, but if it is 0, 1 2 or 3, the control will update it as appropriate.

Example: M49Pnn Qmm Sets the status of pallet nn to a value of mm. Without a P-code, this command sets the status of the currently loaded pallet.

M50 Perform Pallet Change

Using an M50 on the dual pallet APC cycles the pallet changer to the next pallet. M50 can have a P-code which specifies a pallet, or no P-code which cycles the pallets. On the Quad APC, an M50 with no P-code will load the next scheduled pallet. If none are scheduled, the message NONE SCHEDULED will be displayed and program execution will pause until one is scheduled or RESET is pressed. M50 P0 will unload a pallet from the receiver without loading another. M50 with a P-code loads the specified pallet. M50 gets scheduling information from the Pallet Schedule Table.

M50 P0 Perform pallet change
M50 P1 Load Pallet 1
M50 P2 Load Pallet 2
M90 Unload Pallet from receiver

G CODES

G188 Get Program From PST Calls the parts program for the loaded pallet based on the PST entry for the pallet



4.3 SAMPLE PROGRAMS

Example #1:

Basic program using the “Schedule Pallet” light on the APC. This program will run the same part program on each pallet.

Oxxxx	Program number
M36	(Flash “Schedule Pallet” light, wait until SCHEDULE PALLET button is pressed to continue)
M50	(Perform pallet change after “Schedule Pallet” button is pressed)
Part Program	(USER’s PART PROGRAM)
M99	(Repeat program)

Example #2:

Basic pallet change program that tracks which part is to be machined on each pallet. Pallet #1 has a different machine operation than pallet #2

Oxxxxx	Program number
M36	(Flash “Schedule Pallet” light - wait until SCHEDULE PALLET button is pressed to continue)
M50	(Perform pallet change after “Schedule Pallet” button is pressed)
M96 Q27 Pxx	This line will check to see if pallet #1 is on the machine. If it is then it will jump to line xx. If the pallet is not on the machine, then it will continue to the next line. Q27 checks to see if pallet #1 is on the machine.
M99	(Repeat program)
Nxx	Line number
Part program	User’s part program for Pallet #1 for Pallet #1
M99	(Subroutine return)
Nxxx	Line number
Part program	User’s part program for Pallet #2 for Pallet #2
M99	(Subroutine return)

NOTE: M99 at the end of the program will cause continuous operation. M30 at the end of a program will cause the control to wait for the operator to press Cycle Start.

Example #3:

This is another method for achieving the same results as example 2.

M36	(Flash “Schedule Pallet” light - wait until SCHEDULE PALLET button is pressed to continue)
M50 P1	(Load Pallet #1)
M98 Pxx	(Control jumps to program #xx and runs this program.)
M36	
M50 P2	(Load Pallet #2)
M98 Pxxx	(Control jumps to program #xxx and runs this program.)
M99	(Repeat program)



FMS SAMPLE PROGRAMS

Example #1:

Basic pallet change program that loads the next scheduled pallet and runs the correct parts program. The next pallet and the correct program are determined from the PST. Below is a sample of a Pallet Schedule Table (Sample Table 1). The table indicates that pallets #2, #3 and #4 are scheduled and that pallet #1 is unscheduled (column 3 "Pallet Status"). The pallets will be processed in the order #3, #4 and finally #2 (column 2 "Load Order") with the program indicated in column 5, "Program Number". The "Program Comment" is captured from the program listed in column 5.

Pallet Schedule Sample Table 1

Pallet Number	Load Order	Pallet Status	Pallet Usage	Program Number	Program Comment
1	0	UNSCHEDULED	12	O06012	(CUT SLOT)
2	3	SCHEDULED	13	O05870	(DRILL AND TAP)
3	1	SCHEDULED	22	O04990	(ROUGH AND FINISH TOG)
4	2	SCHEDULED	8	O06012	(CUT SLOT)
O00001		Program number			
M50		(Perform pallet change to next scheduled pallet)			
G188:		Calls the parts program for the loaded pallet based on the PST entry for the pallet			
M99		(Loop to top of main program)			
O04990					
Part program		(User's part program)			
M99		(Return from subroutine)			
O05870					
Part program		(User's part program)			
M99		(Return from subroutine)			
O06012					
Part program		(User's part program)			
M49 Q12		Set current pallet status to 12 actual string defined by operator, in this case status number 12 is defined as "LAST PALLET"			
M99		(Return from subroutine)			

Description: The first loop through program O00001 will load pallet #3 (M50) and run program O04990 (G188 selects program from PST for pallet #3). The PST will then resemble Sample Table 2. The asterisk for pallet #3 in the "Load Order" column indicates that this pallet is in the mill.



Pallet Schedule Sample Table 2

Pallet Number	Load Order	Pallet Status	Pallet Usage	Program Number	Program Comment
1	0	UNSCHEDULED	12	O06012	(CUT SLOT)
2	2	SCHEDULED	13	O05870	(DRILL AND TAP)
3	*	LOADED	23	O04990	(ROUGH AND FINISH TOG)
4	1	SCHEDULED	8	O06012	(CUT SLOT)

Description: The second loop through program O00001 will load pallet #4 (M50) and run program O06012 (G188 selects program from PST for pallet #4). While pallet #4 is being machined, the PST will then resemble Sample Table 3.

Table Pallet Schedule Sample Table 3

Pallet Number	Load Order	Pallet Status	Pallet Usage	Program Number	Program Comment
1	0	UNSCHEDULED	12	O06012	(CUT SLOT)
2	1	SCHEDULED	13	O05870	(DRILL AND TAP)
3	0	COMPLETED	23	O04990	(ROUGH AND FINISH TOG)
4	*	LOADED	9	O06012	(CUT SLOT)

Description: The third loop through program O00001 will load pallet #2 and run program O05870. While program O05870 is running, the PST will resemble Sample Table 4.

Table Pallet Schedule Sample Table 4

Pallet Number	Load Order	Pallet Status	Pallet Usage	Program Number	Program Comment
1	0	UNSCHEDULED	12	O06012	(CUT SLOT)
2	*	LOADED	14	O05870	(DRILL AND TAP)
3	0	COMPLETED	23	O04990	(ROUGH AND FINISH TOG)
4	0	LAST PALLET	9	O06012	(CUT SLOT)

Description: In the fourth loop, the M50 will detect that no pallets are scheduled. The beacon light will flash green and program O00001 will pause until the operator schedules a pallet or presses RESET. A pallet can be scheduled by pressing any of the SCHEDULE PALLET buttons at either of the two pallet changer station panels. Pallet scheduling can also be done from the control in the PST page of the current commands display.

Example #2:

Basic pallet change program that tracks which part is to be machined on each pallet. Each pallet has a different machine operation. Note that the P code for M46 is a line number in the current program, not a subroutine number.

Oxxxxx Program number



M50	(Perform pallet change after SCHEDULE PALLET button is pressed or PST is updated)
M46 Q1 Pxx1	This line will check to see if pallet #1 is on the machine. If it is then it will jump to line xx1. If the pallet is not on the machine, then it will continue to the next line.
M46 Q2 Pxx2	(If pallet #2 is loaded, program will jump to line xx2, otherwise it will go to the next line)
M46 Q3 Pxx3	(If pallet #3 is loaded, program will jump to line xx3, otherwise it will go to the next line)
M46 Q4 Pxx4	(If pallet #4 is loaded, program will jump to line xx4, otherwise it will go to the next line)
M99 Pxxxx Nxx1	(Jump to line Nxxxx (Line number)
Part program for Pallet #1	(User's part program for Pallet #1)
M99 Pxxxx Nxx2	(Jump to line Nxxxx (Line number)
Part program for Pallet #2	(User's part program for Pallet #2)
M99 Pxxxx Nxx3	(Jump to line Nxxxx (Line number)
Part program for Pallet #3	(User's part program for Pallet #3)
M99 Pxxxx Nxx4	(Jump to line Nxxxx (Line number)
Part program for Pallet #4	(User's part program for Pallet #4)
Nxxxx	(Line number)
M99	(Repeat program)

Example #3:

This is an alternate method to Example #2 that uses subroutine calls, but does not jump if the pallet is unscheduled.

M36 P1	(Flash NO PALLET SCHEDULED on display, flash green beacon, flash light on SCHEDULE PALLET button for pallet #1 until button is pushed or pallet is scheduled in PST)
M50 P1	(Load Pallet #1)
M98 Pxxx1	(Control jumps to program Oxxx1 and runs this program. See Mill Operator's Manual for a more detailed description of M98.)
M36 P2	(Wait for pallet to be scheduled)
M50 P2	(Load Pallet #2)
M98 Pxxx2	(Control jumps to program Oxxx2 and runs this program.)
M36 P3	(Wait for pallet to be scheduled)
M50 P3	(Load Pallet #3)
M98 Pxxx3	(Control jumps to program Oxxx3 and runs this program.)



M36 P4	(Wait for pallet to be scheduled)
M50 P4	(Load Pallet #4)
M98 Pxxx4	(Control jumps to program Oxxx4 and runs this program.)
M99	(Repeat program: see Mill Operator's Manual for a more detailed description of M99)

NOTE: M99 at the end of a program will cause continuous operation. M30 at the end of a program will cause the control to wait for the operator to press Cycle Start.

SYSTEM VARIABLES

The following system (macro) variables are available for dual APC. These variable are generally read-only. Pallet priority (#7501-#7504) and pallet status (#7601-#7604) are read-write during some conditions, but read-only for others. For example both are read-only while the pallet is loaded. These variable are maintained in memory during power off.

VARIABLES	USAGE
#3028	Number of pallet loaded on receiver
#7501-#7504	Pallet priority
#7601-#7604	Pallet status
#7701-#7704	Part program numbers assigned to pallets
#7801-#7804	Pallet usage count

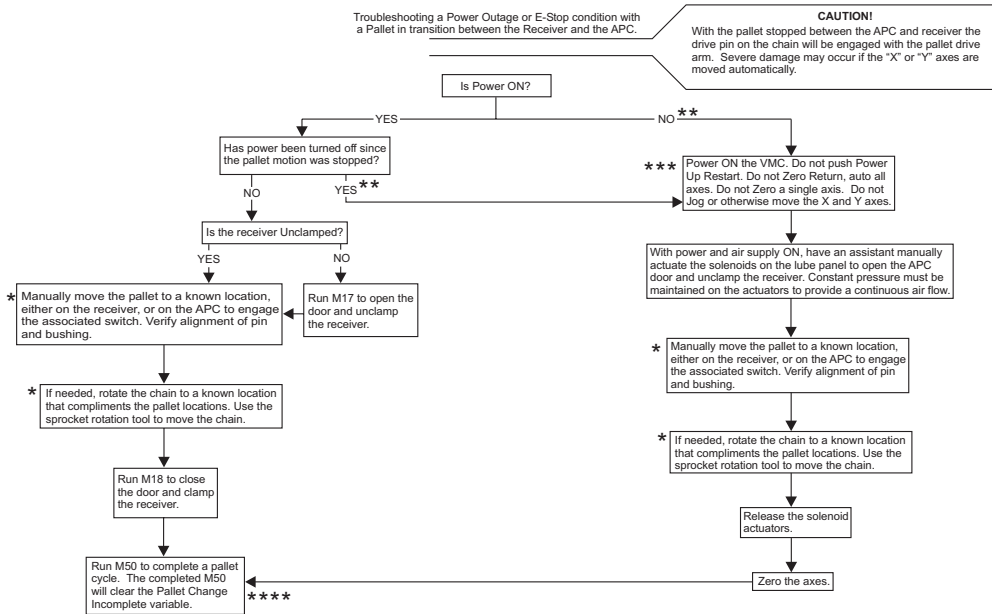


5.0 PALLET CHANGER RECOVERY

The M50 pallet change must be successfully completed before normal operations can continue.

If the pallet change is interrupted, another pallet change must be run to reset the machine. If this puts the wrong pallet into the VMC then an additional pallet change must be run.

The operator must exercise caution when running multiple M50 commands to position pallets. The operator must be aware of incomplete fixturing, tool, and personnel locations.



★ There are 5 switches involved in the location of the pallets and chain.
1 pallet switch on the receiver (Pallet Clamp Switch).
2 pallet switches on the APC (Pallet Home Switches).
2 chain switches on the APC (Pin Clear Switches).

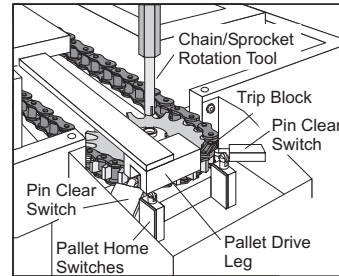
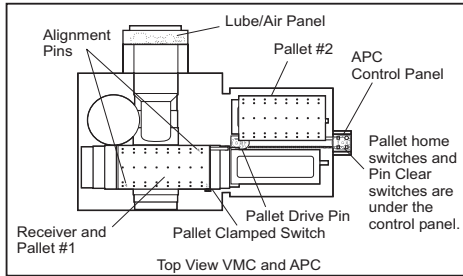
★★ If the power to the VMC has been shut down either intentionally or by power outage, damage may occur to the APC pallet, the receiver, or the drive chain if the X or Y axes are moved in the VMC at power ON.

★★★ At power ON the VMC will investigate the pallet and chain location and alarm if either an unknown chain location or unknown pallet location are detected.

★★★★ At the beginning of the APC M50, a Pallet Change Incomplete variable is set to 1 and reset to 0 at the end. The VMC will not operate properly if a pallet change (M50) has not been completed.

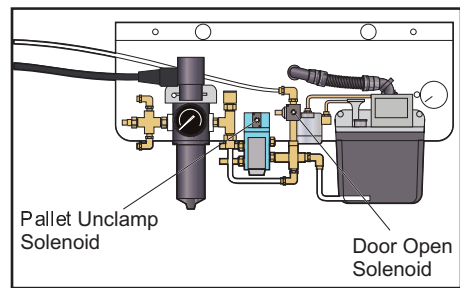
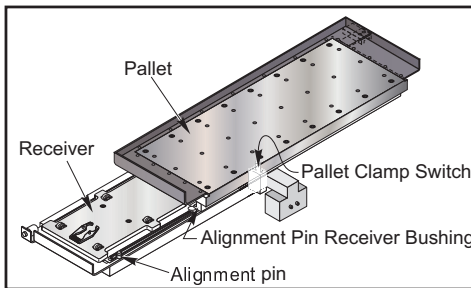


5.1 TROUBLESHOOTING



Pallet 2 at Home Position

Pallet known locations. Pallet 1 is on the receiver and engaging the Pallet Clamped switch (Pallet must be clamped to trip this switch). Pallet 2 is on the APC and engaging the Pallet Home Switch under the control panel.



Alignment Pin and Bushing alignment must be verified when manually positioning a pallet on the receiver.

To manually activate the air solenids, press and hold the solenoid actuation buttons. This will keep manually unclamp the receiver and hold the door open. If the buttons are released the door will close and the receiver will clamp.



