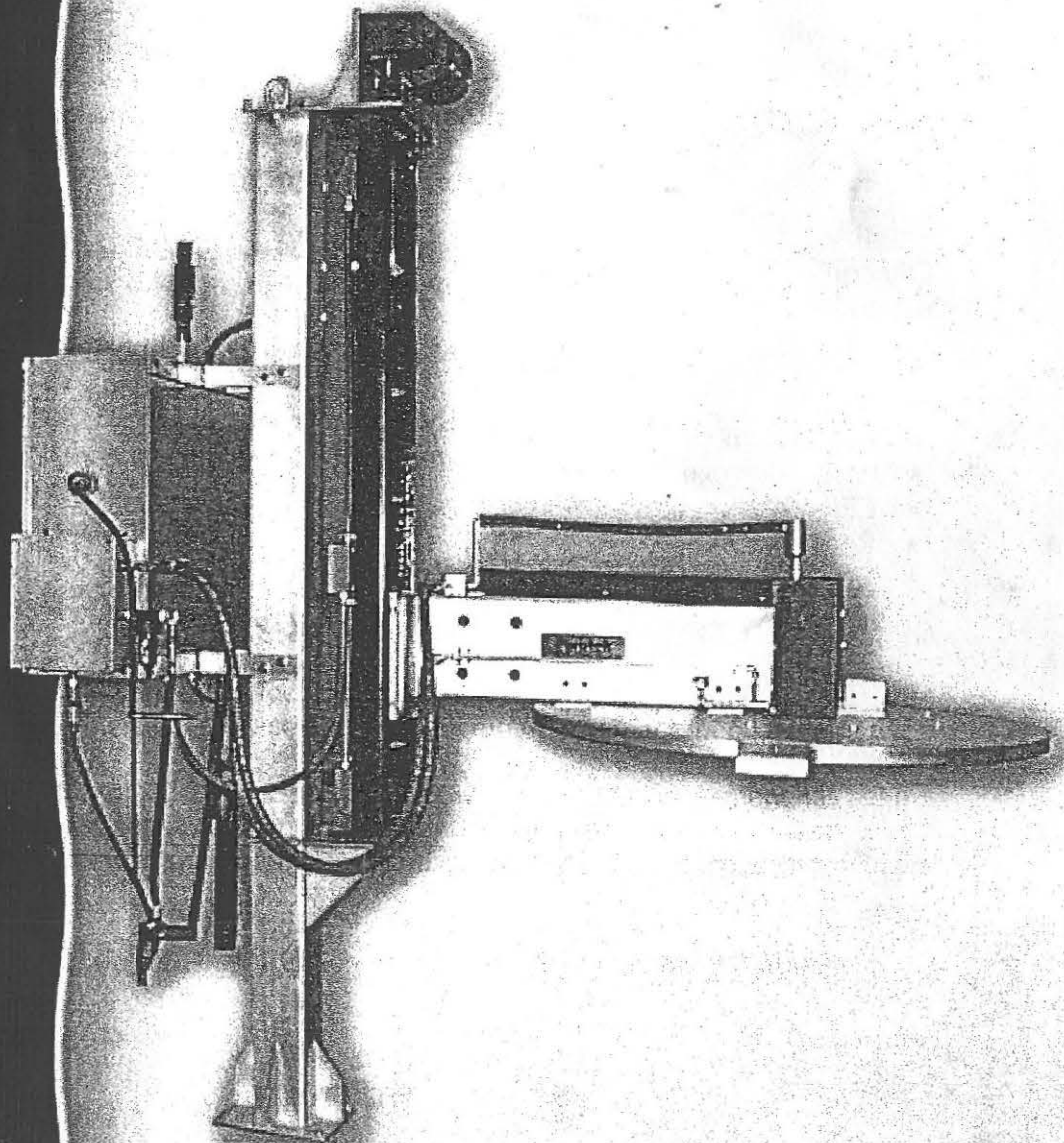


Pyrotek

PAL 3000

Operation & Maintenance Manual



**PAL PART NUMBER
A-DEGF68**

For service and
reorder please contact:
Pyrotek Inc.
9740 Jordan Circle
Santa Fe Springs, CA 90670
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SEPTEMBER 2002

OUR MISSION STATEMENT

Pyrotek is the leading international company supplying technical products and services to the aluminium industry.

We are committed to:

- Customer Satisfaction
- Employee Development
- Profitable Growth
- Integrity
- Reliability, Quality and Service
- Environmental Awareness
- Partnerships with Customers and Suppliers

Our mission is to provide innovative solutions to customer problems utilizing our global resources.

OUR DEDICATION TO YOU

Our commitment to customer service began with the company's inception in 1956. Today you can depend on Pyrotek for innovative solutions to your high-temperature material requirements.

ADVANTAGES OF USING THE PAL 3000

- The most efficient removal of oxides, other dross impurities, and hydrogen currently available
- Production of dry dross practically free of metallic aluminum
- Cleaner furnace walls due to oxide removal
- Reduced furnace emissions
- Reduced flux usage

WARRANTY INFORMATION

Pyrotek, Inc. warrants the PAL 3000 to be defect-free in material and workmanship for six months from the date of purchase. Pyrotek will correct all defects by repair or replacement of the parts.

Pyrotek, Inc. will not repair or replace the PAL 3000 during warranty if the equipment has been altered, repaired by others, used in an application not intended for its use, abused, or damaged. The liability of Pyrotek with this warranty shall not exceed the cost of repair or replacement of the PAL 3000.

The serial number is embossed on a metal tag attached to the inside of the control cabinet.

SERIAL NUMBER _____

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Pyrotek

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INSTALLATION CONSIDERATIONS AND ASSEMBLY

SECTION 1

WE CAN HELP!

Pyrotek's experienced field service engineers can assist you in design issues and any questions you may have about flux selection and injection applications, as well as many other areas dealing with your high temperature product needs.

PREORDER CHECKLIST AND UTILITY REQUIREMENTS

To facilitate efficient, problem free start-up, the following facility requirements must be confirmed for PAL (Processing ALuminum) operations.

- ☐ Clean, dry shop air at 100 psi/50 cfm minimum
- ☐ Dry, high purity nitrogen or argon (generated or bottle) at 50 psi/100 SCFH (Standard Cubic Feet per Hour) minimum
- ☐ Standard Power: 480 VAC, Three-phase
NOTE: Your equipment may have been altered to suit you individual power requirement.

INSPECTION OF EQUIPMENT

Pyrotek takes extra care to ensure safe shipment of equipment. Upon receipt, carefully open all shipping containers and inspect the equipment. If you find any damage to the contents of the crate, notify your carrier immediately.

NOTE: The graphite shaft/rotor is not part of the machine and should be ordered separately. Contact your field service engineer for more information.

PART NUMBERS

Component Name	Part Number
Arm components	
Drive Belt	MDU022
2Hp Electric Motor on Arm	FBDU96
Lower Heat Shield	M-DEG070
Rotary Union Coupling	DEG134
Upper Heat Shield	M-DEG071
Shaft Bearings (2 ea.)	FBD183
Rotary Union	FXIJ123

INSTALLATION CONSIDERATIONS AND ASSEMBLY

Component Name	Part Number
Cabinet Components	
Pressure Gauge	CAB980
Pressure Regulator at Inlet	FXIJ240
Inlet Regulator Gauge	FXIJ242
Nitrogen Detector Pressure Switch	FBD153
Feeder Hose, Braided, 1/2" x 10'	FXIJ352

DEGASSING SYSTEM SPECIFICATIONS

Standard unit:

- Stationary unit secured to the floor
- Weight approximately 970 pounds
- 480 VAC, three-phase, 60 Hz
- Electric motor drive
- Allen-Bradley PLC controls
- PLC programmed degassing setting. Program variables include:
 - Degas timer
 - Rotor speed
 - Gas flow
- PLC provides capability of adjusting spinning graphite rotor speed from 0-450 RPM, and increasing gas flow for degassing purposes
- Total automated cycle
- Multi-colored light tower with solid/flashing operational indicators and audible siren
- Column mounted electric cabinet
- Electric powered motor and gear for vertical movement of arm
- Ceramic baffle for anti-vortexing
- Insulated shroud and heat barrier
- Vortex cooler - drive shaft and bearing cooling system
- Operates with either nitrogen or argon gas
- Gas flow metering 0-100 standard cubic feet per hour (SCFH)
- Emergency stop button
- Manual mode selection
- Heavy duty construction
- 7/8" Acme carbon steel shaft
- Electric screw drive moves arm up/down into metal bath
- Manual left/right swing for graphite removal and replacement
- Automatic operation. Steps include:

INSTALLATION CONSIDERATIONS AND ASSEMBLY

Standard unit (continued):

- Arm is positioned over metal bath
- One button start
- Splitter gas turns on
- Arm moves graphite shaft into bath via electric screw drive
- Gas flow increases a degas cycle begins
- After the degassing cycle, the arm returns to home position
- Cycle is complete
- Epoxy finish for added durability
- Completely assembled
- Six (6) month warranty

Accessories:

- Graphite shaft and rotor

Optional equipment:

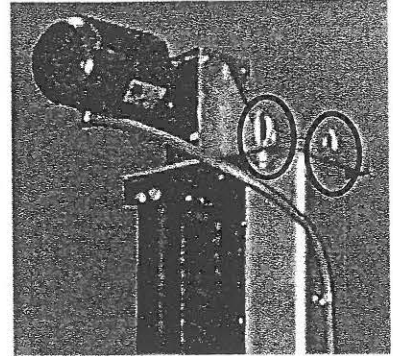
- 220 VAC, single phase, 50Hz
- 220 VAC, single phase, 60 Hz
- 240 VAC, single phase, 50 Hz
- 415 VAC, three phase, 50 Hz
- 380 VAC, three phase, 50 Hz
- Heavy duty drive shaft for longer than 32" graphite/rotor; (1-1/8" Acme), and polar rotors
- Electric: Pyrotek can design the PAL 3000 for 200 to 250 VAC three-phase and any voltage between 400 to 480 input volts
- Total automated cycle including arm rotation (clockwise or CCW)
- Optional electric powered gear box for rotation of arm
- Data retrieval from PLC
- Networking of PAL units - PLC/Ethernet connection to customers LAN based system
- High temperature package. Includes 7/8" Acme Stainless Steel Shaft and High Temperature Bearings
- 1-1/8" Acme Carbon Steel Shaft. Required if graphite is longer than 32"
- High temperature package for graphite longer than 32". Includes 1-1/8" Acme stainless steel shaft and high temperature bearings
- Left/ Right Rotation. Includes switch on control panel
- Insulated splash shield. Need to determine cost on a square foot basis
- Temperature monitoring (thermocouple or similar)
- Optional hearth mount

INSTALLATION CONSIDERATIONS AND ASSEMBLY

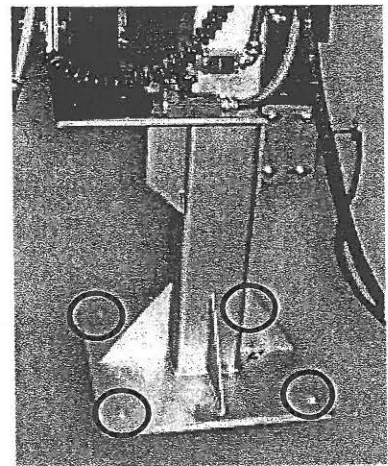
ASSEMBLY

1. Position and attach the column to the floor.

- A. Remove the column unit from the crate. There are two eyebolts at the top of the column unit. A chain can be looped through the two eyebolts to lift it from the crate.



- B. Place the column in the desired position and secure to the floor with 3/4" anchors. A minimum of two-inches of thread should protrude above the floor for mounting the base of the column. Be sure the column is installed level and square.



2. Attach the arm assembly to the installed column.

- A. Remove the arm assembly from the crate and attach it to the column assembly using four 1/2" bolts (provided).

ASSEMBLY NOTE: The control box is mounted on the left side of the electric control box for a right-hand swing machine. For a left-hand swing machine, mount the pneumatic control box on the right side of the electric control cabinet.

INSTALLATION CONSIDERATIONS AND ASSEMBLY

3. Connect the arm motors to the electric cabinet.
 - A. Connect the power cords from the main drive motor and rotary feed motor into their respective cabinet connections.
4. Connect factory inert gas to the cabinet.

NOTE: During operation, an error condition will occur if a pressurized gas supply is not applied to the unit. This error will not allow the programming mode to be entered.

- A. Remove the female half of the 1/4" diameter quick-disconnect from the inert inlet on the cabinet and attach to the factory inert gas supply line.
- B. From the factory inert gas supply, run a line to the main inert gas connection on the bottom of the pneumatic control box. This is the 1/4" quick-disconnect.

NOTES: There is splitter gas in the line to allow 3 SCFH (Standard Cubic Feet per Hour) to always flow through the line during the processing cycle (when the arm moves down from its upper "home" position). This provides a positive pressure in the line to prevent molten aluminum from entering the shaft and solidifying (plugging the line) if the unit is idle or power is lost while the shaft/rotor is in the metal, or at the end of the processing cycle.

During operations, if the degassing system will not be used for a long period (such as overnight), disconnect the inert gas input.

5. Connect shop compressed air to the vortex cooler hose.
 - A. From the factory air supply, run a line to the 3/8" quick-disconnect air inlet located on the right side of the pneumatic control box.
6. Connect power.
 - A. Connect 480 VAC three-phase power (or factory specified) to the control panel.

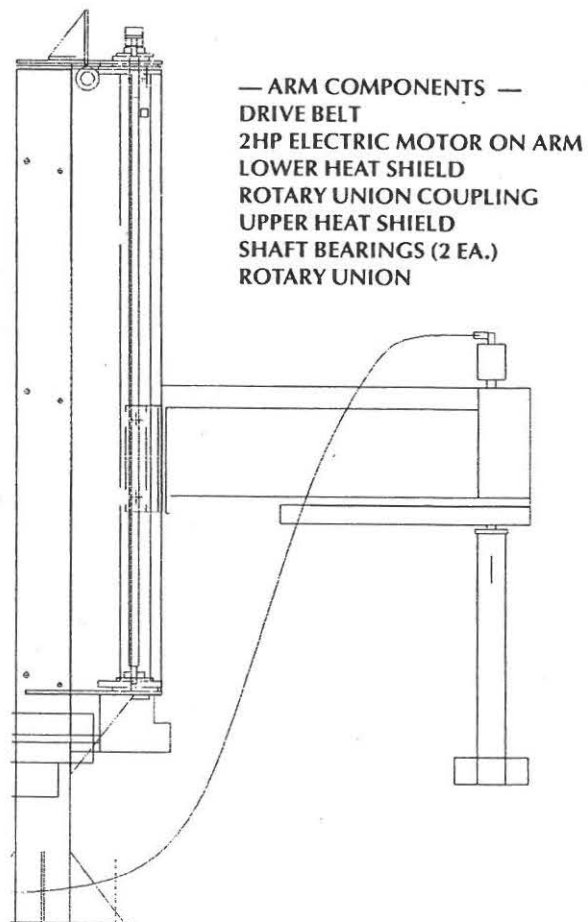
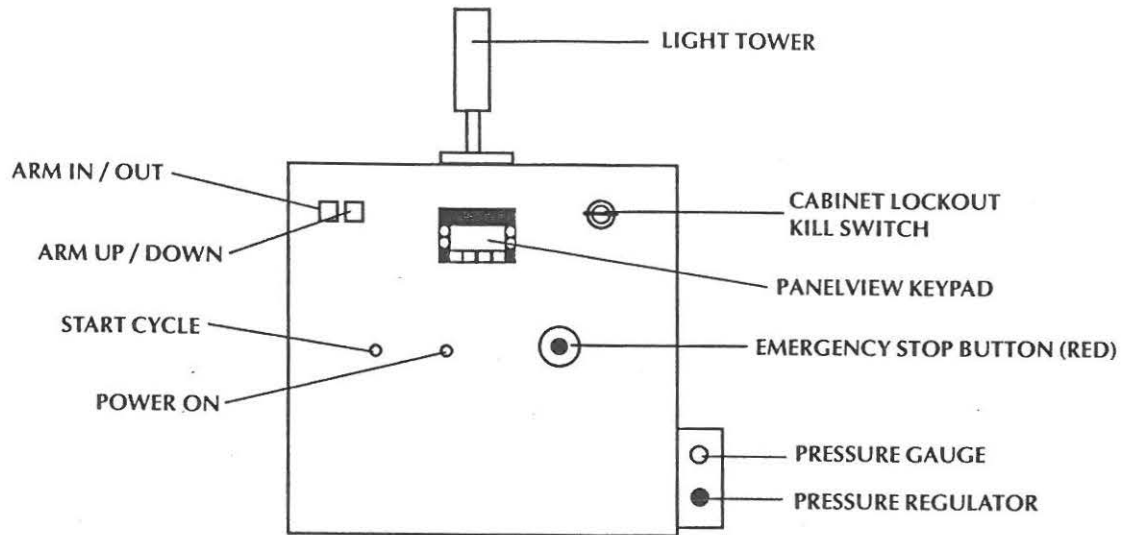
NOTE: An internal transformer steps-down the 480 voltage to 110 VAC for the control panel's operating voltage.

7. Attach the injection hose from the arm assembly to the cabinet rotor/inert gas outlet.

EQUIPMENT OVERVIEW

SECTION 2

EQUIPMENT COMPONENTS



EQUIPMENT OVERVIEW

DEVELOPMENT AND USE

Pyrotek-Santa Fe Springs, CA, developed the PAL 3000 to help the foundryman:

- Improve the quality of aluminum alloys
- Reduce operating costs
- Produce a cleaner work environment

This product is designed as a stationary, fixed base, spinning-rotor, degassing system. As a dedicated aluminum processing station, it injects inert gas throughout the molten aluminum below the metal line through the rotating graphite shaft/rotor. This technology of inert gas injection is the state-of-the-art method of providing purified aluminum.

The PAL 3000 was engineered to address the foundryman's needs and the foundry environment, providing years of dependable and reliable service with minimum maintenance. It is easy to use. The degas cycle is automatic and repeatable after initial timer setting. Safety features are designed into the unit to help ensure accident-free operation. The graphite shaft and rotor are easily moved in and out of the melt with the self-contained moving mechanism. The arm can be rotated either 90 degrees right or left manually, or with the optional electric powered gear box.

THE PURPOSE OF DEGASSING

Inert gas can be piped from a central source directly to the degassing system for metered distribution. A metered amount of inert gas is injected into the molten aluminum through a rotating graphite shaft/rotor. The shaft/rotor shears the inert gas into tiny bubbles and disperses them evenly throughout the melt. Hydrogen and nonmetallic inclusions are attracted to the inert gas bubbles and rise to the surface. Spinning shaft/rotor degassing can decrease hydrogen content up to 65% (cc/100g Al), versus 20-40% decreased hydrogen obtained with wands or lances.

FACTORS THAT AFFECT DEGASSING

The time required to degas molten aluminum is dependent on a variety of factors, including:

- Metal temperature
- Initial gas content
- Desired gas content
- Alloy type
- Type of gas used
- Amount of gas used
- Volume of molten aluminum

EQUIPMENT OVERVIEW

Spinning shaft/rotor degassing can decrease hydrogen content up to 65% (cc/100 g Al). The time required to achieve this result is a factor of the above variables. The most influential variable is the temperature of the aluminum. Molten aluminum at 705° C (1300° F) will degas almost twice as fast as aluminum at 760° C (1400° F).

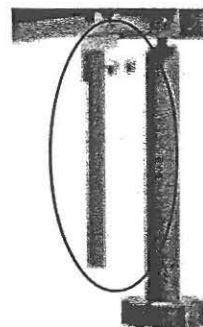
Tests show there is a slight improvement in degassing time based on the type of inert gas used. Argon gas outperforms nitrogen but is usually more expensive. Either gas is recommended. Sulfur hexafluoride, SF₆, can be used as a blend gas with either nitrogen or argon.

NOTE: Unless it has been specifically ordered, this machine is not designated for use with chlorine due to chlorine danger and adverse effects on the environment..

DEGASSING TIPS

The control setting of 40 standard cubic feet per hour (SCFH) of nitrogen (47 SCFH of argon) and 350 RPM on the shaft/rotor is the designated starting guideline. Factors to consider when developing parameters for your application include the following:

- A gentle movement of the molten aluminum with a maximum amount of tiny bubbles rising to the entire surface area results in the best degassing efficiency.
- Always have the baffle in place. The baffle reduces vortexing. Vortexing causes reintroduction of oxides and hydrogen into the melt.
- A shaft/rotor rotating at a high RPM will increase vortexing, even with the baffle in place.
- Excess gas flow causes larger bubbles around the shaft/rotor. The larger bubbles will not be sheared, decreasing the effectiveness of the 3000.
- For maximum efficiency, the spinning shaft/rotor should be positioned 50-100 mm (2-4 inches) from the floor of the furnace. The spinning shaft/rotor should never be higher than the midpoint of the melt.



EQUIPMENT OVERVIEW

PRECAUTIONS

WARNING!

Authorized operators should read and understand all instructions and warnings. Improper use of this equipment could result in personal injury, damage to equipment, or both.

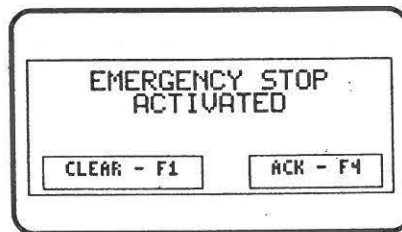
- Always wear protective clothing and equipment while operating this machinery. See your Pyrotek field service representative for available clothing and equipment.
- Never disconnect safety switches or safety valves. The switches are designed to avoid personal injury or equipment damage.
- The equipment should be used in a level position with the shaft/rotor perpendicular to the melt.
- Electric power should be disconnected before servicing the control cabinet.
- Inspect the equipment for damaged or worn parts. Do not use unsafe equipment.
- Ensure work area is clear of obstruction.
- Prior to injection into the molten metal, always ensure the graphite shaft/rotor has been properly preheated. This is typically completed by positioning the graphite 1" above the metal for approximately 15 minutes. Preheating bakes off moisture from the shaft/rotor.
- Verify the shaft/rotor will not make contact with the furnace floor or the sidewalls.
- Never bump the shaft/rotor or baffle against another object.
- Never install a graphite shaft longer than 32". Graphite longer than 32" requires a heavy duty drive shaft, no less than 1-1/8" diameter.
- This equipment uses an automatic operation. In the automatic cycle, the machine starts and stops without warning. Proper safeguards and barriers should be installed to protect personnel.

EQUIPMENT OVERVIEW

EMERGENCY STOP BUTTON

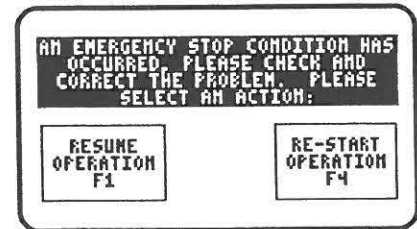
An emergency stop button is located on the control cabinet. Pushing this knob shuts down all operations, displays an EMERGENCY STOP ACTIVATED error (illustrated) on the PanelView keypad and illuminates the red light on the light tower. Pressing either selection turns off the red light and presents the Emergency Stop screen (illustrated on the following page).

At this time the error must be corrected.



When operations are ready to continue, restart the machine by twisting the emergency stop button clockwise and pulling it back out. The red light will go out and the following screen will be displayed. An audible alarm will also sound until the Start Cycle button is pressed.

- If "resume" is selected, the injection process continues in the cycle where it was prior to the interruption. Press the Start Cycle button to continue the countdown with the time remaining.
- If "re-start" is selected, the injection process begins over at the beginning of the cycle. Press the Start Cycle button to begin the processing cycle over.



SHAFT / ROTOR UP AND DOWN MOVEMENT

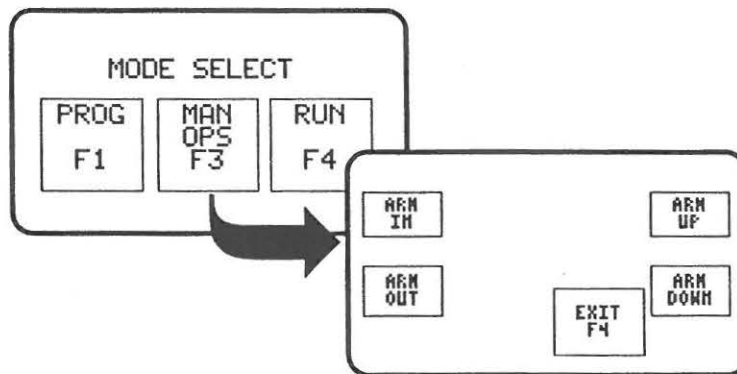
The up/down movement of the shaft/rotor assembly on all machines is electrical. Movement is automatic during a flux/degas cycle, and can also be manual through the same keypad interface as illustrated above.

EQUIPMENT OVERVIEW

COLUMN ARM ROTATIONAL MOVEMENT

The arm assembly has approximately 180 degree total movement to the left and right. The standard machine requires manual movement of the arm with a pin to locate and stabilize the arm at the desired location. This pin is a safety feature to prevent accidental rotation during operation and to prevent the arm from contacting the side of the furnace.

An option provides for electrical right/left, or in/out movement. (In = movement in toward the metal, out = movement out of the metal.) Electrical movement is achieved through an electric motor controlled through the keypad interface. The screen providing this feature is available by selecting Manual Operations from the MODE SELECT screen.



PROGRAMMING THE PAL 3000

SECTION 3

INITIAL STARTING GUIDELINE

The machine is preset to operate at 40 SCFH of nitrogen (47 SCFH of argon) and 350 RPM on the shaft/rotor, during fluxing and degassing. Your experience and the variables listed in the calculations above result in optimal settings and time for each of your applications.

EQUIPMENT SETUP

1. Connect power.
 - A. Connect 480 VAC three-phase power (or factory specified) to the control panel.

NOTE: An internal transformer steps-down the 480 voltage to 110 VAC for the control panel's operating voltage.

2. Connect factory inert gas.

NOTE: An error condition will occur if a pressurized gas supply is not applied to the unit. This error will not allow the programming mode to be entered.

- A. Remove the female half of the 1/4" diameter quick-disconnect from the inert inlet on cart panel and attach to the factory inert gas supply line.
- B. Connect the factory inert gas supply line to the inert inlet pneumatic control box.

NOTES: There is splitter gas in the line to allow 3 SCFH (Standard Cubic Feet per Hour) to always flow through the line during the processing cycle (when the arm moves from its upper "home" position). This provides a positive pressure in the line to prevent molten aluminum from entering the shaft or wand and solidifying (plugging the line) if the unit is idle or power is lost while the wand is in the metal.

If the degassing system will not be used for a long period (such as overnight), disconnect the inert gas input.

INITIAL STARTING GUIDELINE

The machine is preset to operate at 40 SCFH of nitrogen (47 SCFH of argon) and 350 RPM on the shaft/rotor, during fluxing and degassing. Your experience and the variables listed in the calculations above result in optimal settings and time for each of your applications.

EQUIPMENT SETUP

1. Connect power.
 - A. Connect 480 VAC three-phase power (or factory specified) to the control panel.

NOTE: An internal transformer steps-down the 480 voltage to 110 VAC for the control panel's operating voltage.

2. Connect factory inert gas.

NOTE: An error condition will occur if a pressurized gas supply is not applied to the unit. This error will not allow the programming mode to be entered.

- A. Remove the female half of the 1/4" diameter quick-disconnect from the inert inlet on cart panel and attach to the factory inert gas supply line.
- B. Connect the factory inert gas supply line to the inert inlet pneumatic control box.

NOTES: There is splitter gas in the line to allow 3 SCFH (Standard Cubic Feet per Hour) to always flow through the line during the processing cycle (when the arm moves from its upper "home" position). This provides a positive pressure in the line to prevent molten aluminum from entering the shaft or wand and solidifying (plugging the line) if the unit is idle or power is lost while the wand is in the metal.

If the degassing system will not be used for a long period (such as overnight), disconnect the inert gas input.

PROGRAMMING THE PAL 3000

USING THE PANELVIEW KEYPAD

Programming communication to the internal controller is completed through the PanelView keypad.

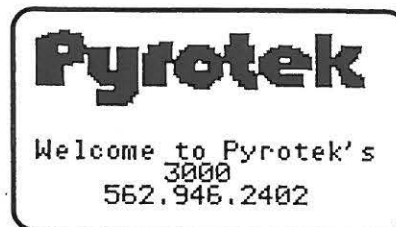
- ← Left arrow = previous screen in a series or move left
- Right arrow = next screen in a series or move right
- ↑ Up arrow = line up
- ↓ Down arrow = line down
- F1 – F4 = assigned functions
- ↵ = enter



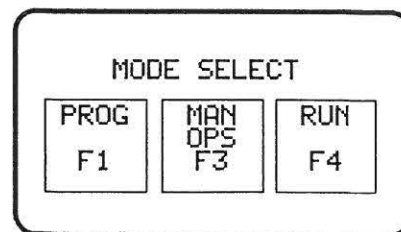
ASSIGNING PROGRAM PARAMETERS

1. On power-up, various preliminary PanelView screens are displayed, followed by the "Welcome to Pyrotek's 3000" screen. This screen displays for 15 seconds, then automatically advances to the MODE SELECT screen.

NOTE: To advance to the MODE SELECT screen before completion of the 15 second delay, press →.



2. The MODE SELECT screen allows entry to the programming mode, manual operations, or the running of a programmed injection cycle. Press F1 to enter the programming mode.



3. A PASSWORD screen (not illustrated) is displayed after the program mode is selected.

PROGRAMMING THE PAL 3000

4. Enter the password of 31.

NOTE: At any time, press **F1** to escape (ESC) this screen. An **ACCESS DENIED** error screen is displayed if an incorrect password was entered.

- A. Press **↑** three times. This advances the first space to the number 3.
- B. Press **→** once to advance to the second digit.
- C. Press **↑** one time to enter the number 1.
- D. Press **↵** to accept the password entry.

5. The **SELECT SPINNING ROTOR SPEED AND GAS FLOW RATE** screen is displayed.

SELECT SPINNING ROTOR SPEED AND GAS FLOW RATE		
ROTOR SPEED	GAS FLOW	
HHH RPM F1	HHH SCFH F2	ACCEPT F4

- A. Enter the speed for shaft/rotor rotation. Maximum selectable speed is 450 RPM.
- B. Press **F1** to bring up the ROTOR SPEED set point screen. The cursor defaults to the right-hand digit.
- C. Enter the value in the fields for the RPM. Enter numeric values using the **↑** and **↓** keys. Select digit fields by using the **→** and **←** keys.
- D. When entry of ROTOR SPEED is complete, press **↵** to accept your entered value and return to the **SELECT SPINNING ROTOR SPEED AND GAS FLOW RATE** screen. (Press **F1** - ESC to return to the selection screen without accepting entered values.)
- E. Enter the amount of gas flow. Press **F2** to bring up the GAS FLOW set point screen. The cursor defaults to the right-hand digit.
- C. Enter the value in the fields for the SCFH. Enter numeric values using the **↑** and **↓** keys. Select digit fields by using the **→** and **←** keys.
- D. When entry of GAS FLOW is complete, press **↵** to accept your entered value and return to the **SELECT SPINNING ROTOR SPEED AND GAS FLOW RATE** screen. (Press **F1** - ESC to return to the selection screen without accepting entered values.)
- E. Press **F4** to accept the values and advance to the next screen.

PROGRAMMING THE PAL 3000

6. The DEGAS TIMER screen is displayed.

DEGAS TIMER

F1	F2	F3
####	0#	0#

HH : MM : SS

ACCEPT
F4

- A. Determine the time desired for degassing.
- B. Press **F1** to bring up the HOURS set point screen. The cursor defaults to the right-hand digit.
- C. Enter the value in the fields for the hours. Enter numeric values using the $\uparrow$ and $\downarrow$ keys. Select digit fields by using the $\rightarrow$ and $\leftarrow$ keys.
- D. When entry of HOURS is complete, press $\leftarrow$ to accept your entered value and return to the DEGAS TIMER screen. (Press **F1** - ESC to return to the DEGAS TIMER screen without accepting entered values.)
- E. Press **F2** to bring up the MINUTES set point screen. The cursor defaults to the right-hand digit.
- F. Enter the value in the fields for the minutes. Enter numeric values using the $\uparrow$ and $\downarrow$ keys. Select digit fields by using the $\rightarrow$ and $\leftarrow$ keys.
- G. When entry of MINUTES is complete, press $\leftarrow$ to accept your entered value and return to the DEGAS TIMER screen. (Press **F1** - ESC to return to the DEGAS TIMER screen without accepting entered values.)
- H. Press **F3** to bring up the SECONDS set point screen. The cursor defaults to the right-hand digit.
- I. Enter the value in the fields for the seconds. Enter numeric values using the $\uparrow$ and $\downarrow$ keys. Select digit fields by using the $\rightarrow$ and $\leftarrow$ keys.
- J. When entry of SECONDS is complete, press $\leftarrow$ to accept your entered value and return to the DEGAS TIMER screen. (Press **F1** - ESC to return to the DEGAS TIMER screen without accepting entered values.)
- K. Press **F4** to accept the value and advance to the next screen.

PROGRAMMING THE PAL 3000

7. The ACCEPT PROGRAM EDITS screen is displayed.

A. Press **F1** to accept edits.

NOTE: F4 discards your program entries and returns you to the MODE SELECT screen.

ACCEPT PROGRAM EDITS?	
YES F1	NO F4

8. After accepting your program entries, the MODE SELECT screen is redisplayed.

9. Entry of your degas program parameters are now complete.

MODE SELECT		
PROG F1	MAN OPS F3	RUN F4

GAS FLOW RATE MM SCFH	PRESS GREEN START CYCLE BUTTON
SPINNING ROTOR MM RPM	
DEGAS TIME MM:MM :SS :SS	
MODE SELECT F4	

NOTE: Program values will be displayed on the PROGRAM RUN screen prior to the operator pressing the start button.

OPERATION

SECTION 4

BEFORE YOU BEGIN

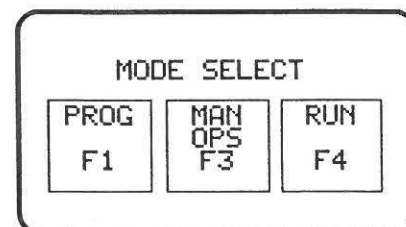
Section 2, "Equipment Overview," details operational precautions and use of the emergency stop button. Be sure you understand each prior to beginning operation of the equipment.

Ensure power and inert gas are connected to the unit.

NOTE: There is a splitter valve on the gas line to allow 3 SCFH (Standard Cubic Feet per Hour) of gas to always flow through the line during the processing cycle. This provides a positive pressure in the line to prevent molten aluminum from entering the shaft or wand and solidifying (plugging the line). If the PAL Flux Injector will not be used for a long period (such as overnight), disconnect the inert gas input.

START-UP

1. Select the degas program from the PanelView keypad (illustrated below) according to the following steps.
 - A. Apply power to the unit by turning the power lever to the ON position. Various preliminary PanelView screens are displayed, followed by the "Welcome to Pyrotek's 3000" screen. This screen displays for 15 seconds, then automatically advances to the MODE SELECT screen.



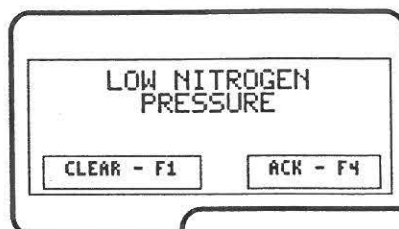
NOTE: To advance to the MODE SELECT screen before completion of the 15 second delay, press ➡.



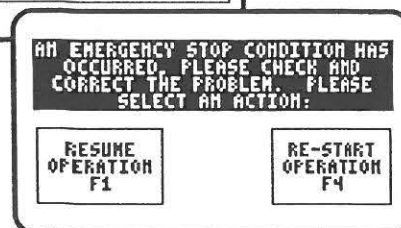
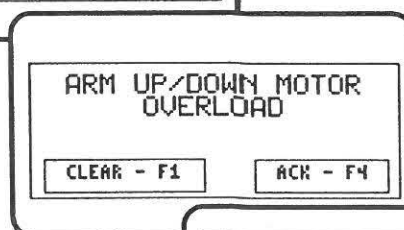
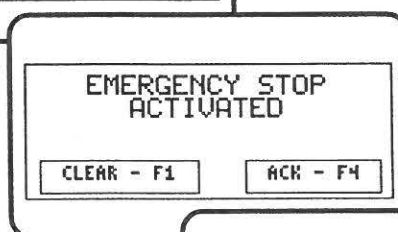
- ◀ Left arrow = previous screen in a series or move left
- ➡ Right arrow = next screen in a series or move right
- ⬆ Up arrow = line up
- ⬇ Down arrow = line down
- F1 – F4 = assigned functions
- ↵ = enter

OPERATION

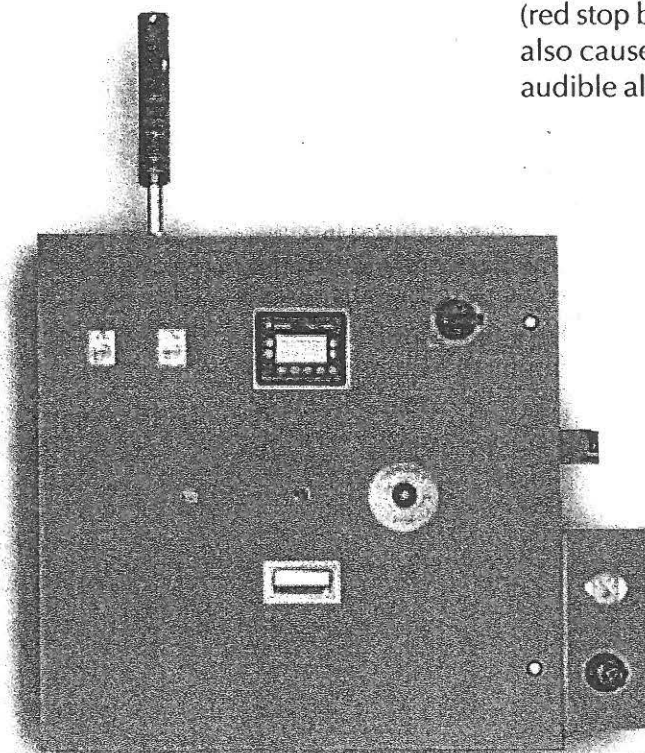
- B. Error conditions detected by the system are defined on the display. The four error conditions are shown below. Remove any error condition prior to advancing to the program selection screens.



Low pressure error
also causes an
audible alarm.

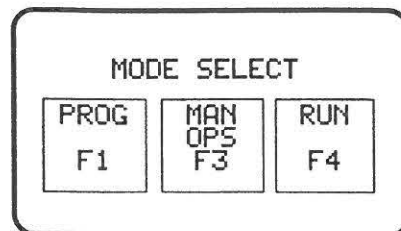


Emergency stop
(red stop button)
also causes an
audible alarm.



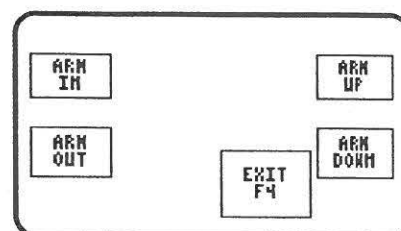
OPERATION

- C. The MODE SELECT screen allows entry to the degassing program, or entry into manual arm operations separate from the programs.



PREHEAT THE SHAFT / ROTOR

- D. From the MODE SELECT screen press F3 to enter the manual operation function. The illustrated screen is displayed for manual movement of the arm.



NOTES: The motorized up/down arm motion is functional on all machines.

The motorized in/out (right/left) arm swing motion is an optional feature.

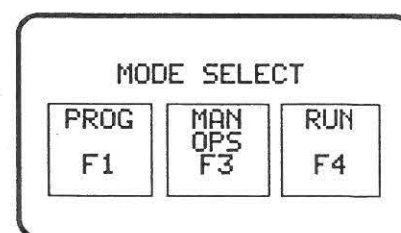
In = into the metal

Out = out of the metal and back to the arm's normal stationary position.

If you do not have this motorized arm swing option, use the pin to keep the arm locked in its proper left/right position.

Preheat the shaft/rotor by positioning it over the melt. Press and hold the applicable keypad keys until the desired position is achieved. (Releasing the button stops the arm movement.) If you do not have a motorized arm swing, position the arm and secure with the pin. Leave the arm in this preheat position until the shaft/rotor is preheated position long enough to remove any moisture from the graphite.

Upon completion of the preheat process, press F4 to return to the MODE SELECT screen.



OPERATION

SELECT AND RUN THE PROGRAM

- E. From the MODE SELECT screen, press **F4** to run a program.

MODE SELECT		
PROG F1	MAN OPS F3	RUN F4

- F. The "Start Screen" is displayed showing the parameters related to the selected program.

GAS FLOW RATE	MM SCFH	PRESS GREEN START CYCLE BUTTON
SPINNING ROTOR	MM RPM	
DEGAS TIME	MMH:MM:SS	
		MODE SELECT F4

- G. Press the green Start Cycle button to begin the automatic injection cycle. During the degas cycle, the OPERATION CYCLE screen is displayed and indicates time remaining for the cycle.

OPERATION CYCLE	
SYSTEM IDLE	
####:##:0# REMAINING	
F1 GAS FLOW ADJ	F3 SPINNING ROTOR

NOTE: The green light on the light tower indicates that the injection cycle is in process. The amber light indicates the process is complete. The red light indicates an error condition.

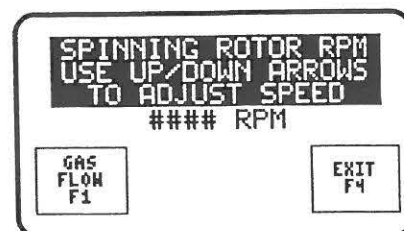
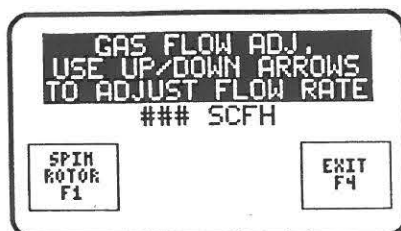
Automatic processing steps:

1. The green light on the light tower is turned on.
2. Arm lowers from its home position.
3. Splitter gas is turned on as soon as the arm leaves the home position.
4. Arm continues to lower until it reaches a preset point on the column.
5. Rotor begins to spin.
6. Degas gas is turned on.
7. Degas continues at a preset quantity for a preset period of time.
8. Degas time completes and the rotor stops spinning.
9. The arm automatically raises and returns to its home position.
10. Splitter gas is turned off.
11. The green light on the tower is turned off and the amber light is turned on.

OPERATION

MAKE ADJUSTMENTS DURING OPERATION

- H. As necessary, from the OPERATION CYCLE screen, press **F1** to adjust gas flow, or **F3** to adjust rotor speed.



2. Cycle Complete

- A. The shaft/rotor stops spinning.
- B. The arm will automatically raise to its upper home position.
- C. The amber light on the light tower indicates the fluxing cycle is complete.

TROUBLESHOOTING AND MAINTENANCE

SECTION 5

TROUBLESHOOTING CHART

<u>Problem</u>	<u>Cause</u>	<u>Solution</u>
No power	Power not connected	Connect power
	Emergency Stop Button pushed in	Turn clockwise and pull out
	"Power On" lever not turned	Turn "Power On" lever
No bubbles floating to surface	Inert gas not being released	Ensure inert gas is on and set at 60 psi (if below 50 psi, system error should display)
	Shaft plugged with aluminum	Clean shaft
Large bubbles floating to the surface	Inert gas flow rate high	Lower flow rate (40 SCFH for nitrogen, 47 SCFH for argon) NOTE: Flow rate can be adjusted at the regulator. If the flow is too high, lower the pressure slightly. In the same manner, if the flow is too low, increase pressure slightly.
	Rotor speed too low	ADD or increase rotor speed
Vortexing	High RPM	Decrease the RPM - 350 RPM suggested
	Baffle bar not in place	Attach the baffle bar
Arm does not raise or lower	Limit switch improperly adjusted	Adjust limit switch
Shaft/rotor not spinning	Drive belt off or broken	Repair/service
	Program not set, or set improperly	Program PLC (programmable logic controller)
	Limit switch not activated	Adjust limit switch

TROUBLESHOOTING AND MAINTENANCE

DAILY CHECKS

Check for worn or damaged parts. Repair or replace components as needed.

Check the upper and lower heat shields. Replace if damaged.

Remove any moisture collected in the air filter by turning the petcock on the bottom of the air filter.

Check hoses for leaks. Replace any damaged hoses.

WEEKLY CHECKS

Check oil level on the air-line lubricator and fill as necessary with a lightweight motor oil.

ANNUAL CHECKS

Examine the condition of the shaft rotor. Replace if worn or damaged. The two rotary feeder shaft seals must also be replaced at the time of rotor replacement.

INERT SPLITTER GAS

The flux cabinet is designed with a splitter valve on the gas line to allow three (3) SCFH (Standard Cubic Feet per Hour) of gas to always flow directly through the shaft/rotor when the source of gas is connected. This prevents molten aluminum from flowing into the hollow shaft and solidifying when the unit is off. If the unit will not be in use for a prolonged time, the main gas supply should be shut off at the source.

NOTE: The splitter valve in the pneumatic box has been preset by the manufacturer. Do not change the setting.

SCHEMATICS

Electric and pneumatic schematics for the 3000 are available from Pyrotek. Refer to these schematics as a troubleshooting aid.