

# **Technical Service Manual**

Phone: 508-653-0082 Fax: 508-653-1736

## MOTION TECHNOLOGY, INC. LIMITED WARRANTY

## 1. Nature of Warranty

This equipment is warranted to be free of manufacturing defects in workmanship and materials for one (1) full year beginning from the date of original retail purchase and subject to the limitations set forth below. The controls package consisting of the main circuit board and keypad are warranted for three (3) years. Any part found to be defective during the warranty period will be replaced with new or rebuilt replacement parts free of charge by Motion Technology, Inc. (MTI). Shipping charges are me responsibility of the purchaser. Service labor is included for a period of one (1) full year beginning from me date of original retail purchase when performed by an authorized MTI service company or designated agent based on straight time rates for work performed during normal working hours. This labor coverage is limited to a fifty (SO) mile radius (each way) and/or 1 hours travel time of a customers location. Any and all other service travel charges will be the responsibility of the customer.

## 2. Scope of the Warranty

This Warranty is extended to the original purchaser for products purchased and retained in the 50 states of me U.S.A. and the District of Columbia. This Warranty shall not be effective unless the equipment was purchased from a dealer or other person authorized by MTI to sell its equipment.

The attached Warranty registration card must be fully completed and mailed within ten (10) days-of receipt to assure the validity of this limited Warranty.

# **3. Exclusions from Coverage of the Warranty**

This Warranty does not cover any damage to the equipment resulting from accident, misuse, abuse or negligence, failure to follow operating, cleaning and periodic maintenance instructions, mishandling, alteration, failure to install in strict conformity with local fire and building codes and regulations, ordinary wear and tear resulting from use, failure to change filters using only manufacturers' supplied at the recommended intervals, or if the installation does not comply with set-up arid installation instructions. The equipment shall not have been previously altered, repaired or serviced by anyone other than a service facility authorized by MTI to render such service

## 4. How to Obtain Service

Notification of a defect in the material or workmanship of *the* equipment, shall be to the MTI Factory Service Manager at me number shown below or me dealer from whom you purchased the equipment. We want you to be a satisfied customer. If a problem does come up that cannot be resolved to your satisfaction, please let us know. Write to Service Manager, Motion Technology, Inc., 6 Huron Drive, Natick, MA 01760-1315. Please be sure to include the Model Number, Serial Number, and the date of original purchase.

## 5. Exclusion of Incidental or Consequential Damage

Repair or replacement under this Warranty is the purchasers sole and exclusive remedy. Neither MTI nor the dealer from whom you are purchasing this equipment will be responsible for any and all incidental or consequential damages, resulting from the use of the equipment or from breach of any express or implied warranty on this equipment. These warranties are in lieu of all other warranties, express or implied, including, but not limited to, the implied warranties of merchantability or fitness for a particular purpose.

## 6. Legal Rights of Warranty

Retain mis Warranty. It gives the purchaser specific legal rights. The purchaser may also have other rights which vary from state to state. MTI suggests that the dealer's dated bill of sale be ratained as evidence of the date of purchase. Some states do not allow the exclusion or limitation of incidental or consequential damages, or allow limitations on how long an implied Warranty lasts, so the above limitations or exclusions may not apply to all purchasers.

Technical Service/Support: (888) 664-6640













ELECTRIC FRYER MODEL MTI-5 The Leader In Ventless Deep-Frying Technology.



## FEATURES:

Integral Ventless Hood Fully-Enclosed Automated Cooking Process Programmable Controls **ANSUL<sup>9</sup>** Fire-Suppression System Warranty: 1 Year Parts/Labor and 3 Years Electronic Controls Package

## **SPECIFICATIONS:**

240 AC Volts Single-Phase
17.5 AMPS @ 4.2 kW Heater Element
6' Power Cord w/NEMA 6-20 Plug
2 Gallon Oil Capacity
20 Lb. French Fries/Hour (Frozen to Done\*)
Clearances: Sides = 2" Back = 2" Top = 24"
Construction: 1 B Gauge Stainless Steel
Shipping Weight: 140 Lb.
Optional Heat Lamp: 110 ACV 4.6 AMPS
\* based on a three minute french fry cook time.



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# — AUTOFRY — ELECTRIC FRYER MODEL MTI-10





## **FEATURES**

Integral Ventless Hood Fully-Enclosed Automated Cooking Process Programmable Controls ANSUL® Fire-Suppression System Warranty - 1 Year Parts & Labor 3 Years Electronic Controls Package



## SPECIFICATIONS

240 AC Volts Single-Phase 3.75 kW Heater Element 18 AMPS@ 208 / 15.63 AMPS @ 240 6' Power Cord w/ NEMA 6-30 Plug (for 208V) NEMA 6-20 Plug (for 240V) 2.75 Gallon Oil Capacity \* 30 lb. French Fries / Hour Frozen-to-Done Clearances: Sides = 2" Back = 2" Top = 24" Construction: 16 Gauge Stainless Steel Shipping Weight: 210 Lb. Optional Heat Lamp: 110 ACV 4.6 AMPS. Shipping Dimensions 32" x 32" x 32"



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# — AUTOFRY — ELECTRIC FRYER MODEL FFG-10







Integral Ventless Hood Fully-Enclosed Automated Cooking Process Programmable Controls ANSUL® Fire-Suppression System Warranty - 1 Year Parts & Labor 3 Years Electronic Controls Package SPECIFICATIONS

208/240 AC Volts Single-Phase 3.75 kW Heater Element 18 AMPS 6' Power Cord w/ NEMA 6-200 Plug 2.75 Gallon Oil Capacity \* 30 lb. French Fries / Hour Frozen-to-Done Clearances: Sides = 2" Back = 2" Top = 24" Construction: 16 Gauge Stainless Steel Shipping Weight: 210 Lb. Optional Heat Lamp: 110 ACV 4.6 AMPS. ' based on a 3 minute french fry / cook time



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# AUTOFRY-

The Leader In Ventless **Electric Fryer Model MTI-40E Deep-Frying Technology.** 



## FEATURES:

Integral Ventless Hood Fully-Enclosed Dual Basket/Automated Food Delivery Programmable Controls Built-in Oil Filtration/Disposal System **ANSUL®** Fire-Suppression System Stainless Steel Construction Warranty: 1 Year Parts/Labor and 3 Years Electronics Controls Package

## SPECIFICATIONS:

240 Volt 16 kW Total 39 Amp. @ 240 Volt 3 Phase 6' Cord w/NEMA 15-50 Plug 120 Volt 4.5 Amp. Oil Filtration System 50 Lb. Oil Capacity 10% Cold Zone 60 Lb. French Fries/Hour (Frozen to Done\*) Shipping Weight: 400 Lb. Clearances: Sides = 2" Back = 4" Top = 24" \*based on a three minute french fry cook time.



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# AUTOFRY

## Gas Fryer Model MTI-40G\* \*Gas Must Vent To The Outside

## The Leader In Ventless Deep-Frying Technology.



## FEATURES:

Integral Ventless Hood Fully-Enclosed Independent Fry Vats Dual Basket/Automated Food Delivery Programmable Controls Built-in Oil Filtration/Disposal System **ANSUL**® Fire-Suppression System Stainless Steel Construction Warranty: 1 Year Parts/Labor and

3 Years Electronics Controls Package

32" \_\_\_\_\_ SPECIFICATIONS: 130,00BTU/Hr. Total

120 ACV 15 Amp. Required
120 Volt 4.5 Amp. Oil Filtration System
50 Lb. Oil Capacity
10% Cold Zone
60 Lb. French Fries/Hour (Frozen to Done\*)
Shipping Weight: 400 Lb.
Clearances: Sides = 2" Back = 4" Top = 24"
Class "B" Gas Vent Required ( Consult Local Codes]
Available for natural gas or propane
\* based on a three minute french fry cook time.

NSF

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рн: [508] 553-0082

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BOCA-ES

Model Name	FFG-10	MTI-10	MTI-10	
Voltage	208 Volt - 240 Volt	208 Volt - 240 Volt	208 Volt* -240 Volt	
Wattage	3750 ( N/A for 240 Volt)	3750 both 208 & 240	4160 (208)& 4800 (240)	
Amperage	18.03 (208) & 15.63 (240)	18.03 (208) & 15.63(240)	20 amps	
Hz	50/60	50/60	50/60	
Phase	1	1	1	
Plug Configuration	NEMA6-20	6-30 (208) & 6-20 (240)	NEMA 6-30	
Serial Numbers	1500-A through 4936-A	4890-A through 6553-10	6554-10& Up	
Thermistor Style	RTD	RTD	"K" Type Thermocouple	
Controller Style	Milwaukee (10079)	Milwaukee (10079)	NCC(10079K)	
Note			*208 Volt, 4160 Watt Special Order	
Listings	ETL, NSF, CSA	UL, NSF,CSA	UL, NSF, CSA	
Changes	No Longer Manufactured	Using Ansul Fire System	3 Amp Fuse on 2nd side of Transformer	
Serial Number Ranges	4936-A Last	4890-10	7197-10	
Changes		MTI-10 UL Listing		
Serial Number Ranges		4890-10		
Changes		Watlow RTD Probes		
Serial Number Ranges		5966-10		
Changes		Class CC Fuse		
Serial Number Ranges		5475-10		

Model Name	AFI-5	MTI-5	MTI-5 (Far East Export Modified)	
Voltage	120 Volt	240 Volt	200 Volt	
Wattage	1725	4200	3000	
Amperage	14.375	17.5	15	
Hz	50/60	50/60	50/60	
Phase	1	1	1	
Plug Configuration	NEMA15-5	NEMA6-20	NEMA 6-20	
Serial Numbers	Up to 1999-5	2000-5 & Up	2000-5 & Up	
Thermistor Style	"K" Thermocouple	"K" Thermocouple	"K" Thermocouple	
Controller Style	NCC Self Service	NCC(10079K)	NCC(10079K)	
Note	Export Only	Replaces AFI-5	Replaces AFI-5	
Listings	UL,NSF,CSA,CE	UL, NSF, CSA, CA	UL, NSF, CSA, CE	
Changes		Removed external On/Off Switch	h	
Serial Numbers Range		2097-5		

Model Name	MTI-401PH	MTI-40 3PH	MTI-40E 1PH	MTI-40E 3PH
Voltage	240 Volt	240 Volt	240 Volt	240 Volt
Wattage	12000	12000	16000	16000
Amperage	50	28.9	66.67	38.54
Hz	50/60	50/60	50/60	50/60
Phase	1	3	1	3
Plug Configuration	Hard Wired	NEMA 15-50	Hard Wired	NEMA 15-50
Serial Numbers	1000-40 through 1065-40	1000-40 through 1065-40	1111-40 and Up	1111-40 and Up
Thermistor Style	RTD	RTD	"K" Type Thermocouple	"K" Type Thermocouple
Serial Numbers	1066-40 through 1110-40	1066-40 through 1110-40		
Thermistor Style	"K" Type Thermocouple	"K" Type Thermocouple		
Controler Style	Milwaukee (10079)	Milwaukee (10079)	NCC (10079K)	NCC (10079K)
Serial Numbers	1000-40 throughl 065-40	1000-40 through 1065-40		
Controler Style	NCC(10079K)	NCC 10079K)		
Serial Numbers	1066-40 through 1110-40	1066-40 through 1110-40		
Note	Integral Oil Filtration Syst.	Integral Oil Filtration Syst.	Removable Oil Filtration	Removable Oil Filtration
Listings	UL, NSF, CSA	UL, NSF,CSA	UL,NSF,CSA	UL,NSF,CSA
Changes			2" Ball Valves	2" Ball Valves
Serial Number Range			1111-40	1111-40
Changes			Three Blowers	Three Blowers
Serial Number Range			1111-40 Thru 1141-40	1111-40 Thru 1141-40
Changes			Single Blower	Single Blower
Serial Number Range			1142-40	1142-40
Changes			Dual Vat	Dual Vat
Serial Number Range	· · · · · · · · · · · · · · · · · · ·		1111-40	1111-40
Changes	Motor Numbers	Motor Number	Motor Number	Motor Number
	40042 (R.S)&10042 (L.S.)	40042 (R.S)& 10042 (L.S)	40042R (R.S) & 40042L	40042R (R.S.) & 40042L (LS.)
Serial Number Range	1110-40 and Lower	1110-40 and Lower	1111-40 and Up	1111-40 and Up



Figure 1 - Safety Circuit Overview

The safety circuit is comprised of 8 separate switches that are wired in series. They terminate at the circuit board 10079 at terminal M4 positions 8 & 9 and circuit board 10079K at J3. Should any of these switches open the MDR (Mercury Displacement Relay) coil will de-energize and the display at the keypad will go blank or display Sft.

#### The exception to this is as follows,

If, after the cook cycle has started, one of the safeties opens, the AUTOFRY will continue the cook cycle. At the completion of the cook cycle the AUTOFRY will de-energize the MDR coil and shut off.

The AUTOFRY cannot be re-started until the open safety circuit condition is corrected. However, if the oil temperature is at or above 150° F the fan will continue to run.

There are three basic switch types utilized in this circuit,

- 1. Plunger style momentary switches (part no. 10028-S)
  - For all the filters, the front door, the stack cover and the filter cover plate
- 2. Diaphramtype air flow switch.(X06313)
  - To monitor the airflow.
- 3. Normally open Air pressure switch (no part no.)
  - To monitor the tank pressure at the fire system.

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Access to all but the front door safety, that is located behind the keypad, will be made from the rear of the AUTOFRY.

### Trouble Shooting:

- 1. Press the ON key, the fan starts and runs for 10-12 second then shuts off and there is never a display at the key pad or the display reads Sft.
  - Check that the front door is closed and making contact with the safety.
  - Check for a worn door gasket or a loose door latch.
  - Ensure that all filters are installed and that the filter cover plate is installed.
  - Excessive grease build-up at one of the safety switches.
  - Inspect the tank pressure gauge at the fire system sight window. It needs to be in or slightly over the charged zone.
  - Look for any obstructions at the stack cover.
  - Check that the stack cover louvers are open. The fan should be visible through the louvers.
  - Airflow switch out of adjustment.
  - Loose connections at any of the safety switches.
- 2. The AUTOFRY operates; however, it shuts off just after a cook cycle, fan continues to run.
  - Loose connection to a safety switch.
  - Airflow switch out of adjustment.
- 3. The AUTOFRY shuts off by its self at no specific time, fan continues to run, Sft at display.
  - Loose connection to a safety switch.
  - Airflow switch out of adjustment.
- 4. The AUTOFRY was just cleaned and now it does not start up, the fan does not operate or the display reads Sft.
  - Debris caught in fan blades, air-flow switch does not close.
  - Loose or no connection to main power.

#### Inspecting, adjusting and testing the safety circuit:

Prior to accessing the rear chamber, it is a good idea to test the physical operation of each of the plunger style switches to ensure that they are in good working order.



Figure 2 - Front view of plunger switches

Ensure that all components are installed and are making a solid contact with there respective switches.

## NOTE:

The fan must be operating in order to check the airflow switch. Prior to removing the rear access cover do the following to start the fan,

- Unplug the heater plug and the RTD plug or Thermocouple Plug from the bottom of the heater box.
- Press the ON button at the keypad.
- When the display shows 417 or Prb press the OFF key. At this time the wait light should be blinking and the fan should be operating.

Remove the rear access panel.

Check that all the wire terminals are securely fastened to the safety switches. Check for any breaks in the circuit. Check that the termination at M4 or J3 on the circuit board is secure and that the red and black wires are screwed in tightly to the 2-pin plug. With all components installed in the AUTOFRY and the front door closed perform a continuity test across all the safety switches.

## NOTE:

There may be three loose wires at the fire system; these wires are for the building egress pressure switch. Some state codes require that the fryer be linked to the building fire alarm, this switch is for those applications only and need not be connected to the AUTOFRY safety circuit.



Figure 3 - Rear view of safety switches

The Model MTI-5 safety circuit functions the same as the safety system for the models FFG-10 and MTI-10. The only notable differences are as follows...



The front door safety switch is located at the lower right hand comer of the front door opening. Access to this switch is made through the access panel at the left side of the **AUTOFRY.** 

The other difference involves the removable top panel and fire damper assembly and it's safety switch.



The illustration shown at the left shows a top view of the MTI-5 with the top panel removed. Highlighted is the removable fire damper. To the left of the damper is the safety switch. The damper must be installed in order for this switch to close and complete the safety circuit. If the damper assembly should close the airflow switch will open the safety circuit deenergizing the heater circuit and displaying Sft on the keypad display.

NOTE: Removal of the top panel also aids in working on other related components.

#### Adjusting the MPL air switch

In order to adjust the air switch you need to:

- 1. Unplug the AUTOFRY from the wall
- 2. Turn the unit around to gain access to the rear panel
- 3. Remove the rear access panel
- 4. You will see the air switch; the switch is black in color and round (about the size of a hockey puck). You will notice either a clear or gray air hose attached to it).
- 5. Remove the sealant fro the center of the air switch

**CAUTION!!** You must remove all of the sealant from the center of the switch, so you do not strip out the adjusting screw.

- 6. Using a 1/8" Alien wrench turn the adjusting screw 2 complete turns to the left, which is in a clockwise direction.
- 7. Install the rear cover.
- 8. Plug in the AUTOFRY and turn it on.

See the attached diagram for reference,



#### Remove sealant from allen set screw

#### AUTOFRY Models FFG-10 & MTI-10 Safety Circuit

#### Additional Notes and Information:

Depending on the model and date of manufacture the air flow switch may not look like or be located in the same position as the one shown in figure 5. Some models incorporated a small black box type air switch that is located on the component board, (follow the clear plastic hose to locate this switch). This style switch is adjustable; however, the technician will need to use a 1/16" flat screwdriver to adjust the sensitivity on this switch.

If the AUTOFRY has been stored in bellow zero temperatures for any extended period of time (1 week or more) the liquid in the fire system cylinder may have "Jelled". This condition will affect the pressure switch on the system tank. Allow the system to thaw at room temperature until the switch responds.

If the installation of the AUTOFRY is at high altitude there may not be sufficient air pressure to activate the airflow switch. It may be necessary to adjust the switch to its lowest setting.

If the AUTOFRY is exposed to extreme high temperature an over-heating at the circuit board may result. This condition could result in intermittent shutdowns simulating a safety circuit fault. Allow adequate ventilation at the rear of the AUTOFRY.



Figure 1 - Basket Motor Circuit for Circuit Boards with an RTD



Figure 1-A Basket Motor Circuit for Circuit Boards with Thermocouple (Polarity Reversed)

comprised of the following components,



- 1. 12 VDC Basket Motor Assembly (part no. 10042) includes the following,
  - Motor bracket (part no.10109)
  - Normally open switch (N.O.)(part no. 10034)
  - Normally closed switch (N.C) (part no. 10034)
  - Teflon seal (part no. 10037)
  - Switch cam (part no.10036)

- 2. Wire Assemblies as follows
  - Motor Harness (part no. 8-10)
  - NC switch normally closed connection white with red stripe (part no. 12-10)
  - NO switch common connection black (part no. 18-10)
  - NO switch normally open connection red (part no. 17.10) Circuit board (part no. 10079 or 10079K)

#### AUTOFRY Models FFG-10 and MTI-10 Basket Motor Circuit

The motor assembly is secured to the motor mount within the electrical chamber with 2 ea.  $1/4-20 \times 5/8$ " bolts and lock washers. The motor shaft is fitted with a Teflon seal. The shaft then protrudes through a clearance hole into the cook chamber where the basket cam is then attached to the shaft and held secure with a  $1/4-28 \times 5/8$ " bolt and a small drop of medium thread locker.

Details on removal and testing the basket motor are covered in these instructions.

AUTOFRY Models FFG-10 and MTI-10 Basket Motor Circuit

The basket motor functions to lift and lower the wire food basket through it's "Cycle". This cycle consists of 7 positions,

- 1. Ready
- 2. Cook
- 3. Drain
- 4. Dispense
- 5. Shake
- 6. 2nd Dispense
- 7. Return to ready

These positions are controlled by the switch cam, micro switches and through programs set in the EPROM of the microprocessor.

At the start of a cycle the motor will rotate counter clockwise from the ready position to the cook position.

This is a timed rotation set in program # 14 At the completion of the cook cycle the basket motor will rotate clockwise to the Drain position.

This is a timed rotation set in program # 10

The drain time is set at 12 seconds in program #11. At the completion of the drain time the basket motor will rotate clockwise to the dispense position.

This is controlled when the notch in the switch cam contacts the normally open switch.

The basket motor will rotate counter clockwise from the dispense position to the shake position, hold there for a second then return to the dispense position. There is no sellable programming for this position in the circuit board with the RTD it is in program # 19 for the circuit board with a thermocouple. At the completion of the 2nd dispense position the motor will rotate clockwise until the notch in the switch cam contacts the normally closed switch.

If the basket motor fails to rotate or if it fails to return to the ready position with in 10 seconds the display at the keypad will show the error code of A04.

Trouble shooting:

1. No motor rotation and an A04 at the display.

- Loose or no connection at the positive terminal of the motor (white wire with a black stripe) or, at the negative terminal of the motor (solid white wire).
- Locked rotor at the motor.
- Striped gears.
- Burned traces at the circuit board due to over rotation.
- Frozen or burned relay at the circuit board
- 2. Motor rotates as follows,
  - Right to cook
  - Left to drain
  - Left to dispense
  - Right to shake
  - Left to dispense
  - Right past the ready position continuing for 10 seconds prior to stopping. An A04 at the display with an audible tone. One or all of the following is the cause.
  - Loose or no connection at the normally closed switch (black and or red wires)
  - Loose or no connection at the M4 terminal positions 1 & 2. 9 black and or red wires)
- 3. Motor rotates as follows.

Note: There will not be an A04 error in this case

- Right to cook.
- Right to 45° then stops
- Relays will "Click"
- Right to ready position.

A loose or no connection at the normally open switch (solid white wire or the white wire with the red stripe) causes this

4. The motor functions however the cam does not rotate or the basket does not move.

- Loose basket cam.
- Worn motor shaft.
- Basket not properly installed.
- 5. Basket motor rotates however it is very slow.
  - Transformer secondary side voltage drop
  - Incorrect fuses at the Primary side fuse holder.

Replacing the Basket Motor Assembly (part no. 10042)

- 1. Disconnect the AUTOFRY from main power.
- 2. Open the main door and remove the following components.
  - The wire food basket.
  - The heater box assembly
  - The oil pot.
- 3. With a 7/16" wrench loosen and remove the basket cam from the motor shaft.
  - Inspect the "D" shaped hole for signs of wear and replace the cam if necessary.
- 4. Remove the rear access panel from the AUTOFRY
- 5. With a 7/16" open end wrench or small 1/4" drive ratchet and 7/16"socket loosen and remove the 2 motor mounting bolts and lock washers.
- 6. Disconnect all wires.
  - If helpful tag each wire.



1. Prior to installing a new motor clean all areas of any oil traces.

2. Inspect the replacement motor.

• The replacement motor has been tested at the factory, however, it should be inspected for any damage incurred in shipping.

• Ensure that the Teflon seal is present, if not use the seal from the old motor.

- 3. Inspect all wiring and replace if necessary.
- 4. Inspect the circuit board for any burned traces (see figure 4).

#### AUTOFRY Models FFG-10 and MTI-10 Basket Motor Circuit



• At the backside of the circuit board inspect the traces just above the M2 or J10 terminal block. If these traces are burned replace the circuit board (see figure 4).

• Attach all wires to their appropriate switches and motor terminals.

1. Place the new motor into position on the motor mount bracket and loosely secure with the 1/4 -20 bolts and lock washers.

2. Attach the basket cam to the motor shaft at the interior of the cook chamber.

• Place a small drop of medium strength thread locker to the 1/4 -28 bolt prior to installation.

• There is a "D" shaped hole in the

basket cam that will fit over the motor shaft, it may be necessary to de-bur the hole in order for it to fit over the shaft.

- Ensure that the bolt makes full contact on the motor shaft to prevent the cam from slipping.
- 3. Tighten the motor mounting bolts to a hand tight fit with a 7/16" wrench of socket.

Testing the motor:

## **VERY IMPORTANT!**

#### Test the motor without the basket in place.

If the switch cam notch is not in position at the normally closed switch and the AUTOFRY is turned on the motor will rotate 360° until it contacts the switch. If the basket is in place it will cause damage to the motor and or the circuit board.

Dry testing the AUTOFRY equipped with an RTD ONLY. You can not dry test an AUTOFRY with a thermocouple unless you have a thermocouple simulator.



1. At the circuit board locate and remove the small black jumper cap from position PR2 located 1/4" below the beeper (see figure 5).

• Removing this cap will send a false temperature to the controller allowing the AUTOFRY to operate with out heating the oil.

2. Install the safety circuit jumper into positions 8 & 9 at M4 at the circuit board.

3. Install the oil pot and the heater box.

4. Plug the RTD plug into the heater box.

### **VERY IMPORTANT!**

Do Not plug the heater plug in at this time. Do Not install the wire food basket.

- 5. Plug the AUTOFRY into main power.
- 6. Press the ON key.
  - There will be an audible tone.
  - AUTOFY with RTD ONLY After 10-12 seconds there will be a display at the keypad.
  - AUTOFRY with a thermocouple the display will be instant.
  - The basket motor may rotate to its home or ready position then back ready.
- 7. For the AUTOFRY equipped with a thermocouple you will need to install the heater plug and the thermocouple plug and allow the oil temperature to reach its ready temperature in order to test the basket motor.
- 8. Enter a 10-second time at the keypad and press START.
  - You will want to carefully watch the basket cam to ensure it completes its 7-position cycle. (See figure 6).



Once you have verified that the basket cycles are correct install the wire food basket. The wire food basket should, at the ready position, be at a slight angle out of the oil as shown in figure 7. If the basket is too high, product from the food entry chute will hit the side of the basket and not enter the basket. If the basket rest too low, it may drive down into the heater coils and damage the circuit. Ensure the basket rests as shown in figure 7. The height from the floor of the cook chamber to the top right hand edge of the basket should be approximately 11" -11.5" (see figure 7).



AUTOFRY Models FFG-10 and MTI-10 Basket Motor Circuit To adjust the height of the wire food basket follow these instructions.



To raise the ready height of the basket

1. Remove the basket from the AUTOFRY.

2. With the flange of the basket resting on a sturdy surface place a 10" adjustable wrench on the basket rod end that fits into the basket cam, or the square end (see figure 8).

3. Press down on the wrench to twist the rod slightly.A 1/8" twist in the rod will raise the ready height approximately 1".

4. Re-install the basket into the AUTOFRY and inspect the height.

• Re-adjust as necessary to obtain the desired height. Keep in mind that if the basket is too high product from the food entry chute will hit the side of the basket. It is good practice to test the height using some product.

To lower the height of the basket at the ready position follow the step 1 & 2 from above. Instead of pressing down on the basket rod pull up to twist the rod. Follow step 4 from above.

**VERY IMPORTANT!** Once the motor has been installed and the basket height has been adjusted (if necessary) **replace the cap onto PR2**.

Re-install the rear cover plate and plug in the RTD plug and test the AUTOFRY in a live test condition.

#### AUTOFRY Model MTI-5 Basket Motor Circuit

VERY IMPORTANT

The **AUTOFRY** Model MTI-5 basket and motor rotates in a clockwise direction to discharge product from the food basket. This rotation is the opposite of the Model MTI-10. <u>The basket motor assemblies are NOT interchangeable.</u> The basket motor wiring is as shown in figure 1 below.



FIGURE 1 - MTI-5 Basket Motor Circuit

The basket motor may be protected with an in-line 3 Amp. Slow blow fuse located on the plus side of the wiring.



FIGURE 2 -MTI-5 Basket Motor Assembly (Part Number 50042) - Front View of Switch Cam and Switches.



FIGURE 3 - Basket Cam and Set-Bolt

The basket cam is secured to the basket motor out-put shaft with an %-28 x 5/8" Hex Head bolt



Troubleshooting and diagnostics:

Helpful Hints: Rule out all operator error before dispatching service, for example:

Customer claims that, food entered does not dump out of the *AUTOFRY*. Did they enter food before the ready light was on?

The basket will not dump until oil temperature is at 340°F Did they enter food when the basket was in the second drain cycle? Was the basket installed?

If either of these is the case then, the food is now in the bottom of the oil pot.

A continued build up of food in the oil pot will:

Cause the food basket to "Jump" out of the basket rod receiver clip. Cause excessive order and or smoke,

And may cause the limit to trip.

When testing, replacing or troubleshooting the basket motor always remove<sup>^</sup> the food basket. If the motor counter rotates it will cause damage to the basket motor, fuses or circuit board.

It is strongly recommended that a thermocouple simulator be used to save time on the job waiting for the oil to heat.

Basket motor rotates but basket does not lift:

Loose basket cam. Tighten as needed.

Stripped gears. Replace basket motor assembly.

Check that basket shaft has not jammed into basket rod receiver clip. Replace basket motor assembly.

Display at keypad reads **A04** and Basket motor does not rotate:

Press OFF to clear display and silence "beeping."

Check all wiring to motor. Repair as needed.

Check all wiring at circuit board. Repair as needed.

Check all fuses. Replace as needed.

Replace basket motor assembly.

Basket motor rotates 180 Degrees. The display then reads A04.

Check all wires.

Inspect micro switches and test with meter. Replace as needed.

Basket motor freezes in the drain or dump position:

Remove food basket. Shut off main power, wait 10 seconds and re-start AUTOFRY. If basket motor continues to freeze in up position replace circuit board. If problem persisted replace basket motor assembly.

Basket motor rotates very slowly:

Check voltage at transformer secondary side, there should be 12V dc between the center tap (Orange wire) and each yellow wire. Replace transformer.
Basket motor removal and installation instructions:

Tool required:

Multi-meter Phillips head screw driver 7/16" open-end wrench. 7/16" socket. 1/4" Ratchet Thermocouple simulator

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Use caution when working with electrical power. There is risk of shock.

Remove the food basket from the cook chamber.

With a 7/16" wrench, loosen the basket cam enough to remove it from the motor out-put shaft.

**NOTE:** The bolt is held in place with a small drop of thread locker to prevent loosening during operation.

Remove the rear access panel from the AUTOFRY.

Loosen and remove the two  $\frac{1}{4}$ " blots securing the motor assembly to it's mounting bracket welded in the rear of the *AUTOFRY*.

IMPORTANT: Label all wires prior to removal.

Remove all labeled wires from the basket motor assembly. Compare the old motor to the new motor to ensure that they are the same.

 $\mathbb{NOTE}$ : At this time' with the old motor assembly removed, you may find that the problem with the motor is simply a defective or grease laden switch. As long as the motor gears are in good shape then simply replace or clean the switch.

### Reinstall the New or Repaired Basket Motor Assembly

Connect the switch wires, that were labeled prior to removal of the old or re-built motor (consult the wiring diagram).

Ensure that the motor shaft bushing is installed.

Slide the motor shaft all the way through the hole in the chamber wall.

Securely fasten the motor assembly to the motor mount with the 7/16" bolts and lock washers.

Place a few drops of medium strength lock-tite or thread locker onto the basket cam set bolt.

Slide the basket cam over the motor shaft and check the fit of the food basket. Tighten the basket cam onto the motor shaft.

Make the final two wire connections to the motor plus and minus terminals.



Testing the Motor Installation:

DO NOT INSTALL THE BASKET UNTILL AFTER TESTING THE MOTOR ROTATION. If the motor rotates in the wrong direction with the basket installed it can cause gear damage and or blown fuses.



Begin by jumping out the safety circuit at the circuit board connection J3. By removing the plug with the red and black wires and install the plug with the short yellow wire forming a loop. (see the diagram at the left)

This will allow you to test the motor with the door open. This jumper MUST be removed after the testing is completed.

Install a thermocouple simulator onto the thermocouple socket at the heater box mounting deck. Set the simulator for at least 340° F. This will allow the basket motor to function. Turn on main power and press the **ON** button at the keypad.

The basket motor should rotate from ready to dump the back to ready. If it rotates backwards check the motor wiring polarity.

Basket Motor Circuit Wiring Diagram for Serial Numbers 1111 -40 and Lower.



NOTE POLARITY AT MOTORS

#### AUTOFRY Model MTI-40 Basket Motor Circuit

Basket Motor Circuit Wiring Diagram for Serial Numbers 1110-40 and Higher.



NOTE POLARITY AT MOTORS

#### MTI-40 BASKET MOTORS

For MTI-40 Serial Numbers 1110-40 and lower use the following motor assembly. Part numbers (all parts are viewed from the front of the AUTOFRY). RIGHT SIDE 40042

LEFTSIDE 10042 (same as MTI-10)

For MTI-40 Serial Numbers 1111-40 and up use the following basket motor assembly. Part numbers (all parts are as viewed from the front of the AUTOFRY).

RIGHT SIDE 40042R

LEFT SIDE 40042L



IMPORTANT Motors cannot be interchanges from right to left. IMPORTANT

Note the serial numbers prior to installing any motors. Always make a visual comparison prior to installing any motor assemblies.

The **AUTOFRY Model** MTI-40 basket motor circuit for serial numbers 1110-40 and LOWER have switch wiring as shown in the diagrams) below.



The diagram below shows the rear view of the basket motors for the Models MTI-10 with serial numbers 1110-40 and lower. Note that the polarity has been reversed in order for the motors to rotate counter - clockwise for the lefts side and clockwise for the right side. The left side motor and wiring is identical to the Model MTI-10.



In the diagrams below are the wiring and switch illustrations for **AUTOFRY** models MTI-40E and MTI-40G with serial numbers 1111-40 and higher. These motors are not interchangeable with any other **AUTOFRY** Models nor will they work in MTI-40 Models with serial numbers 1110-40 and lower.



AUTOFRY Model MTI-40 Basket Motor Circuit

As with all basket motor repairs it is important that the technician test the repair WITHOUT the basket installed. This precaution will prevent damage to the basket motor and circuit board in the event the polarity of the motor is incorrect.

Always test any fuses attached to the motor wiring and always test the fuses at the primary side of the transformer prior to beginning any motor repair. Expensive and time-consuming repairs may be avoided by following this advice.

The use of a thermocouple simulator for units equipped with a "K" type thermocouple will also eliminate time-consuming heat-up delays.



When installing a new motor assembly ensure that the Teflon bushing is installed on the motor shaft(s) and that a small drop of medium strength lock-tite is used on the Y4-28 cam bolt. It is good practice to pre-install all wiring before installing the motor assembly.

#### AUTOFRY Model MTI-40 Basket Motor Circuit

For MTI-40 models with serial numbers of 1110-40 and LOWER the basket cam rotations are as follows.

Basket Cam Position For MTI-40 with Serial Numbers 1110-40 and LOWER



For MTI-40 models with serial numbers 1111 -40 and higher the basket cam will start in the **COOK** position and lower only slightly at when the cook cycle is started.

Basket Cam Position For MTI-40E and MTI-40G with Serial Numbers 1111 -40 and Higher





MTI-40 Right Side

## SERVICE REPLACEMENT OF BASKET RECEIVER CLIP

#### TOOLS NEEDED:

- 1. DRILL
- 2. 1/8" DRILL BIT
- 3. (2) 1/8"POPRIVITS
- 4. PÓP RIVIT GUN

#### STEPS FOR REPLACEMENT

- 1. Place new basket clip over old clip on the fryer
- 2. Drill 2 1/8" holes. 1 in the top and 1 in the bottom of the basket clip
- 3. Pop Rivit the new clip over the old clip and into the AUTOFRY
- 4. Install fry basket and check for proper fit
- 5. If the basket won't fit or is too tight, Grind a small portion of the basket rod off and check the fit. Repeat if needed.

RTD (Resistance Temperature Detector) part no. 10065

#### System Overview:

The Circuit board receives signal strength readings from the RTD; those signals are processed via the microprocessor on the circuit board. The EPROM programming determines when the contactor coil should be opened or closed based on oil temperature in degrees Celsius. The oil temperature is displayed at the keypad display in degrees Fahrenheit.

If the RTD signal is interrupted while the machine is in the on mode, even momentarily, the keypad will display 417 and the wait light at the keypad will blink.

If the machine is in the off mode, the wait light will continue to blink.



Figure 1- MTI-10 Wiring Diagram

## Trouble Shooting:

#### Condition:

Blinking Wait light and 417 at display. Erratic temperature displays. Oil temperature over 400°F excessive smoking of oil and the high limit trips:

- 1. Inspect the oil level in the oil pot. The oil level should be approximately 2" from the top edge of the oil pot.
  - Fill the oil pot if necessary
- 2. Inspect the probe for visible damage.
  - Test Probe & Replace if necessary (see Testing the RTD).
- 3. Inspect the connection between the RTD plug and Cable and the heater box socket (see figure 2).
  - Ensure that the connections at the RTD Plug and socket fit firmly.
  - Clean any and all oil from the connections.
  - Replace the plug and or socket if necessary.
  - Replace the cable assembly if necessary.
- 4. Inspect the RTD cable for cracks and or cuts.
  - Replace the cable assembly if necessary.
- 5. Inspect the rubber grommet at the chamber wall. If the grommet is missing the cable may be shorting against the stainless steel chamber wall.
  - Replace the grommet and cable if necessary.
- 6. If all systems test OK at the front of the unit, remove the rear cover plate and inspect the following.
  - The butt splice between the 18/2 cable assembly and the brown and blue #18 gauge wires that connect to the circuit board.
  - The 2-pin connection at M3 on the circuit board.
  - Check with a meter the continuity from the 2-pin connector to the RTD plug to ensure the wiring is secure.
- 7. If the problem persists,
  - Replace the circuit board.

#### Testing the RTD Probe:



With a multi-meter set at 200 ohms. check the resistance at the RTD socket located on the underside of the heater box assembly or remove the socket and test directly at the RTD leads (see figures 2A & 2B). At a room temperature of 70 ° F the resistance should be 108. Often times the RTD probe registers resistance at room temperature, however, as the oil temperature is increased the probe may open. It is wise to gradually heat the probe end while measuring the resistance to ensure that the probe doesn't fail. Using a heat gun, gradually heat the probe end. Apply the heat to simulate the gradual heating of the cooking oil. If the probe is heated too quickly or if the heat application is too high the probe may open.

An accumulation of oil at the RTD socket could simulate an open probe. In this case loosen and remove the two screws securing the RTD socket to the heater box. Remove the socket to expose the two probe leads. Test the probe at the two leads. If the probe registers an ohms reading while being heated then the RTD socket was most likely the problem and should be cleaned or replaced.

Similarly, an accumulation of oil at the RTD plug, attached to the RTD cable, can result in a poor reading between the RTD probe and the circuit board. Inspect the exterior and interior of the RTD plug to ensure the contact, wires and connectors are clean and free from grease.



To install a new RTD probe,

- 1. Loosen and remove the two screws holding the heater box together. Remove the cover from the heater box assembly.
  - The cover is secured to the housing with a silicone sealant; you will need to pry the cover off of the housing.
- 2. Restrain the RTD fitting at the front of the heater box; using an adjustable wrench, loosen and remove the liquid seal nut at the RTD probe threads on the interior of the heater box.
- 3. Disconnect the probe leads from the RTD socket.
- 4. Remove the RTD probe.
  - Please save and return the defective part to the factory.
- 5. Place the new probe end into the probe clip attached to the heater element tubes at the front of the heater box.
- 6. Route the probe leads through the hole in the heater box.
- 7. Gently rotate the probe so that the threaded end is through the hole in the heater box.
  - Do Not twist, bend or break the probe during this installation.

- 8. Place the liquid seal nut over the probe leads. Loosely thread the nut onto the probe fitting. Using an adjustable wrench tighten the nut onto the probe.
  - Ensure that you use a second wrench on the probe nut at the front side of the heater box to keep the probe from twisting during this installation.
- 9. Connect the probe leads to the two outside prongs of the RTD socket.
- 10. Ensure that the probe leads are as far away as possible from any of the power supply wire at the interior of the heater box.

• The RTD is subject to electrical noise interference. It is VERY IMPORTANT that these leads be isolated.

- 11. Replace the heater box cover; reinstall the heater box assembly into the AUTOFRY and test for function.
  - Slide the heater box into position on the oil pot.
  - Ensure that both plugs are secure into their sockets at the bottom of the heater box.
  - Ensure that there is oil in the oil pot.
  - It is not necessary to have the food basket installed at this time; you are only testing the RTD. NOTE: If the wait light is blinking at the keypad, there is a bad connection somewhere in the circuit. You must locate the break in the circuit. Re-inspect all connections.
  - Close the main door of the AUTOFRY, and press the ON button at the keypad.
  - The fan will start.
  - After 10-12 seconds oil temperature will be displayed at the keypad. As the oil is heated the display will indicate the oil temperature; this can sometimes be slightly erratic as the cool oil mixes with the heated oil. At 190 ° F the basket motor will cycle. After approximately 14-15 Min. the display should reach 354° F and the heater will cycle off.
- 12. Open the main door and install the food basket.
- 13. Close the main door and press the ON button.
  - Run a few test cycles to ensure that the AUTOFRY is in good working order.



To upgrade from a three wire RTD to a Two wire RTD using the existing 4 relay circuit board.

- 1. Depending on the type of heater box assembly. It may be necessary to use two /2" washers to fill the old RTD hole (See diagram 1-a).
- At the IEC socket in the heater box, connect the red wire and jump to the LINE and NEUTRAL pins.
- 3. At the IEC socket in the heater box connect the WHITE wire to the NEUTRAL pin.
- 4. Ensure that all the connections are clean. Open and clean the RTD plug.

NOTE: When replacing a three wire circuit board with a two wire board you need to jump the black & white leads to one of the connections of the two pin -connector (M3) and the green wire goes to the other connector.



# AUTOFRY 3 wire to 2 wire RTD







The "K" type thermocouple is the junction formed by joining two dissimilar metals. Proper alloy selection results in a measurable and predictable voltage generated at that junction. This voltage when detected by the circuit board will indicate actual oil temperature.

The circuit board regulates the electrical supply to the heater elements to maintain the oil temperature.

The YELLOW wire is positive the RED wire is negative. Crossing these two wires will result in erroneous temperature or an error code at the keypad display of Prb, A07orA08.



The thermocouple plug and its socket at the bottom of the heater box must be connected plus to plus and minus to minus. Although the pins and sockets are two different sizes it is possible to force the connections together backwards. Always check this connection.

The probe itself is connected with in the heater box assembly. This is a simple two-wire connection. Ensure that the YELLOW lead is connected to the + terminal of the socket and the RED lead is connected to the - terminal. If connected backward oil tempeture will read 761 or the display at the keypad will read A07 or Prb.



## AUTOFRY Model MTI-10 Thermocouple Circuit

Trouble Shooting

**A07** at keypad display (A07 is a frequency conflict error)

- Crossed wires at heater box.
- Crossed wires at circuit board.

**Prb** at keypad display. (Prb is an error for an open probe)

- Plug not installed at heater box.
- · Connections not made at circuit board.
- Loose solder connection at TC1 terminal on circuit board.

Temperature reading of 761 at keypad display.

- Plug not installed at heater box.
- Short in thermocouple.
- Short in thermocouple wiring.
- Plug installed backwards at heater box.
- Crossed wire at heater box.
- Crossed wiring at circuit board.

#### **A08** at keypad display.

(A08 is a temperature difference registered by the controller of 50 deg. In 5 seconds.)

- Check oil level in oil vat.
- Check all connections.

## AUTOFRY Models FFG-10 and MTI-10 Fan Circuit Fan

Circuit Overview:



The fan circuit is comprised of the following components,

- 1. The 240 AC Volt Fan (part no. 10089)
- 2. The Circuit Board (part no. 10079 or 10079K)
- 3. 2 Wire Assemblies,
  - # 18 Gage Blue (part no. 6-10)
  - # 18 Gage Brown (part no. 7-10)

The fan functions to continuously filter the air from the cook chamber through the filters and exhaust it out through the top of the *AUTOFRY*.

#### Trouble Shooting:

- 1. Turn unit on, fan runs for 10-12 seconds then shuts off or display reads Sft.
  - Safety related problem, see safety circuit trouble shooting.
- 2. Fans operated but at very low RPM.
  - Unit supply voltage too low. Verify it is at least 200V AC.
  - Fan is blocked with oil or other materials, remove stack cover and filters then clear fan.
  - Fan is starting to fail, replace fan.
- 3. Fan operated but there is no exhaust from top of unit.
  - Louvers in the stack cover have closed. Remove stack-cover and open louver.
  - Check fan airflow direction.

4. Fan does not operate at all.

- Fan has burned out.
- On board fuses (part No. 10079 Only) have blow.
- Fan relay on board has frozen.
- Branch Circuit Fuses Blown.

Inspecting and Testing:

# CAUTION:

The exhaust fan operates on 220 volts. Ensure that caution in used when working on the fan circuit.



Remove the stack cover at the top of the **AUTOFRY.** Inspect the louvers to ensure that they are open. If they are closed or if the fusible link has broken, it will need to be repaired.



Remove any and all debris that may be accumulated in the fan.

Inspect the condition of the fan and it's wire terminations. Reconnect any loose wires.

Check the voltage at the fan terminals there should be line voltage, however the fan draws only .1 amp.

Spin the fan blades to ensure the fan is not bound.

## At the circuit board (Part # 10079):



Check the 2 amp. fuses on the circuit board at locations at F1 & F2. Check the fuses for continuity. If they are blown change the circuit board. The fuses can be replaced at your shop, or return the board to the factory.

Check the connections at M1 terminal positions 1 & 2. Ensure that they are snug and making good contact.

Check the <sup>1</sup>/<sub>2</sub> Amp. Branch Circuit Fuses. Replace with FNQ R1/2 ONLY.

Test the voltage at these terminals, if there is no voltage tap the relays at K4 and K3, these relays may be stuck. If this does not work replace the circuit board and re-test.



For Circuit Board utilizing the "K" Type Thermocouple there are no on board fuses. The fan terminals will be marked as J9. The fan control relays are marked as K1 and K2 (clear cover relays).

## NOTE:

The exhaust fan will run continuously if the RTD or Thermocouple plug, located in the cook chamber, is not connected to the heater box.

**J9** Fan Terminal

For MTI-40 models with serial numbers of 1110-40 and lower the fan circuit will consist of one 240 V ac exhaust blower located at the top of the fryer filter chamber after the last filter and below the fire damper assembly. To access this blower remove the fire damper cover. There may also be two small 240 V ac cooling fans located in the rear electrical section. These fans function to cool the electronic controls. All fans are wired in series into the last two terminals at M4 or J9 located at the bottom left corner of the circuit boards.



For models with serial numbers 1111-40 thru 1141-40 there are three 240 V ac exhaust blowers used within the filter chamber. There are no cooling fans used for the electrical chamber, as there is more than adequate ventilation in these models.

For models with serial numbers 1142-40 and higher there is a single 240V ac exhaust blower within the filter chamber. Again no cooling fans are used in these models.

#### AUTOFRY Model MTI-40 Fan Circuit

For models with serial numbers 1111-40 and higher accessing the exhaust blower(s) is done by removing the top panel from the *AUTOFRY*. After removing the top panel lift out the fire damper. The fire damper is safety interlocked and must be replaced in order for the appliance to heat.

As with all **AUTOFRY** models the fan circuit is programmed to start when the **ON** button at the keypad is pushed and shuts off when oil temperature falls to below 150° F. Additionally if the thermocouple is not connected to the circuit board the fan will run continuously.

AUTOFRY Models FFG-10 and MTI-10 Key Pad Circuit

Key Pad Circuit Over-View:



Figure 1 - Key Pad Circuit

The keypad circuit is comprised of 3 parts

- 1. The key pad (part no. 10051 and 10051K)
- 2. The ribbon cable (part no. 10050 and 10050K)
- 3. The circuit board (part no.10079 10079K)

The keypad, located at the front of the AUTOFRY, is linked to the circuit board, located in the rear of the AUTOFRY, via a 24 "or 36" ribbon cable. This cable runs through a conduit tube that is visible at the interior of the cook chamber.

The keypad is the user interface to the functions of the fryer. As such it is exposed to grease, chemicals and constant abuse.

## Key Pad Functions



ON Press the ON key to begin heating the oil. **OFF** Press the OFF key to shut the AUTOFRY off. **COUNT** Press the count key to view the number of completed cook cycles. STAND-BY Press the Stand-by key to place the AUTOFRY in the Stand-by mode (Stand-by LED Illuminates). For controller with RTD, Press the Stand-by key a second time to exit the stand-by mode. For controller with thermocouple press clear to exit stand-by mode. **Stand-by LED will go out.** 

## START

The start key will begin the cook cycle and count down.

**WAIT LED** will illuminate during the cook cycle and any time oil temperature falls below 300-340 Deg. F.

## CLEAR

Press the clear key to clear or cancel any cook time or cook cycle.

## **READY LED** (Light)

The ready light will illuminate at 300° F for controller with RTD and at 340 for controller with thermocouple

## WAIT LED (Light)

The Wait light will illuminate during heat up and during a cook cycle.

## **STAND-BY LED** (Light)

The Stand-by light illuminates during the stand-by mode.

NOTE:

If power is interrupted while the AUTOFRY is in the Stand-by mode the Stand-by function may remain active even though the Stand-by light is not illuminated. In this case simply press the Stand-by key.

## AUTOFRY Models FFG-10 and MTI-10 Key Pad Circuit

Cook times for the controller with a thermocouple (10079K).

The maximum cook time is 15 min. and 59 sec.; however, the display is limited to three digits.

For cook times of 10 Min the display will read the letter A followed by the seconds.

For 11 Min. the letter b (the B is in lower case so that it is not confused with the number 8)

For 12 Min. the letter C For 13 Min. the letter D

For 14 Min. the letter E

For 15 Min. the letter F

The display will count down through these letters until time remaining is 3 digits or less.

Minutes are separated from seconds with a colon.

## Trouble shooting:

- 1. No display.
  - Check cable connections
  - Short in display
- 2. Ready, Wait or Stand-by LED does not work.
  - LED cracked or damaged.
  - Short in circuit
- 3. One row of keys does not work.
  - Short circuit
  - Loose ribbon cable.
  - Worn switch membrane.



Figure 2 - Key Pad and Frame



Figure 3 -Key Pad Removal

In all cases it is best if the entire key pad and ribbon cable be removed and replaced. There is no need to spend any time trying to troubleshoot the interior workings of the keypad.

At the front of the AUTOFRY loosen and remove the screws securing the keypad frame. Disconnect the ribbon cable and install the new keypad.

## CAUTION:

Do not ground the contacts of the keypad against the chamber as this could cause a short. If the keypad does short against the chamber the display LED's may not all illuminate, if this does happen, try

disconnecting the cable from the keypad then re-connect. This will sometimes correct the problem. Otherwise a new keypad will be necessary.

Test the new keypad



Ribbon Cable connection at the circuit board

If the problem persists remove the old ribbon cable. Remove the rear access panel, disconnect and remove the old cable from the circuit board. Install the new cable and route it through the conduit to the keypad. Connect the cable to the keypad and re-test.

## NOTE:

In some isolated cases there is an excess of RFI (Radio Frequency Interference) or EMI (Electromagnetic Interference) this can cause some intermittent display shut downs. There may be a need for a stronger EMI filter this can be special ordered. This condition exists very infrequently; however, it is helpful to know.

Heater Circuit Overview



Figure 1 - Heater Circuit

The Heater circuit is comprised of the following components

- 1. MDR (Mercury Displacement Relay/ Power Contactor).
- 2. High Limit Thermostat.
- 3. Heater Element (208 or 240 ACV 3750 Watts or 240 Volt 4800 Watt or 208 Volt 4160 Watt).

Power is supplied to the heater element in the following way,

The Circuit Board receives oil temperature readings from the RTD (Resistance Temperature Detector) or the "K" Type thermocouple, if the oil temperature is below 354°F the coil at the MDR will be energize and the contacts of the MDR will be closed to deliver line voltage to the heater element. When oil temperature reaches 354°F the coil de-energizes and the contacts will open.

If the safety circuit is open the MDR coil will not energize. The safeties MUST be closed in order for the coil to energize. It is possible to by-pass the safeties for the purpose **of testing only.** In the upper right hand corner at the circuit board locate the two pin plug at positions # 8 & #9 for part No. 10079 or position J3 for part No. 10079K (the plug nearest the rear of the AUTOFRY.). There is one red and one black wire connected to this plug, there also may be a second plug with an orange or yellow wire loop ("jumper") hanging loose at this position. Remove the plug and insert the jumper in its place.

If there is no jumper simple remove the red and black wire and form a loop with any conductible wire, then re-insert the plug into the socket. (See figure 2)



If the RTD or Thermocouple circuit is shorted or open (417 or Prb Error Code) the MDR coil will not energize. This circuit is critical to the operations of the AUTOFRY and must be intact at all times.

If the coil of the MDR remains energized for 16 min. and 49 sec. the circuit board will deenergize the coil of the MDR and an error of A05 will be displayed at the keypad. Figure 3 shows the interior view of a typical heater box assembly.

There are 6 components within the heater box assembly they are...

- 1. The Heater Element.
  - Part # 10059-A is 240 Volt, 3750 Watt.
  - Part # 10059 is 208 Volt, 3750 Watt.
  - Part # 10059-D is 240 Volt 4800 Watt
  - Part # 10059-E is 208 Volt 4160 Watt
- 2. The Probe.
  - RTD Part #10065.
  - Thermocouple Part # 10K-Couple
- 3. The High Limit Thermostat.
  - Part #10066
- 4. The Heater IEC Socket
  - Part #10063
- 5. The Probe Socket.
  - RTD IEC Socket Part # 10062
  - Thermocouple Socket Part # SPJ-K-F
- 6. 4 Wire Assemblies.
  - Part # 10-24 (12 Ga. Blue) Heater Socket to Element
  - Part # 10-22 (12 Ga. Brown) Heater Socket to High Limit
  - Part # 10-23 (12 Ga. Green) Heater Socket to Ground
  - Part #10-21 (12 Ga. Brown) High Limit to Element



Figure 3 - Heater Box Interior View

Note that the RTD leads (Red and White) are placed as far from any voltage carrying wires as possible. Also note that the high limit capillary tube must be arranged so as not to make contact with the heater element stud. A small kink should be made in the capillary tube so that if it is pulled from the front of the heater box it will not inadvertently make contact with the heater stud.

The heater elements are case specific, Check the Equipment Identification tag to match voltage, wattage and amperage.

Trouble Shooting A05 or a no heat condition:

1. Re-set the high limit thermostat.

The re-set is located at the bottom of the heater box assembly (small red button). It is sometimes difficult to access with your fingers, if so the eraser end of a pencil is helpful. When re-set there will be a slight "Click" the button will not stay in the up position.

Note: The limit needs to cool to 50 °F below its preset before it can be re-set. Replace the limit switch if it continues to trip.

- 2. Allow the oil temperature to "recover".
- During busy periods product should be cooked in advance and placed in a warming station.
- 3. Low voltage supply.

The AUTOFRY can operate on as little as 190 Volts; however, it will not efficiently heat the oil. Verify the line voltage.

- 4. Low amperage.
- Ensure that the circuit is dedicated and grounded.
- 5. Fouled and grease laden plugs and sockets This will impede the heater circuit.
- 6. Check for any break in the heater circuit. Inspect all wiring, cables and splices.
- A failure in the RTD or Thermocouple circuit could transmit a false temperature. Inspect the RTD or Thermocouple circuit. (See RTD or Thermocouple Trouble Shooting, Testing and Installation)
- 8. Test the heater element for resistance.

Though highly unlikely, the element may be defective, however if the AUTOFRY has been run dry for an extended period of time the element may burn out.

9. Inspect the circuit board for visible scorching or loose connections Replace if necessary.
# AUTOFRY Models FFG-10 and MTI-10 Heater Circuit

#### Inspecting and Testing Procedure:

Disconnect the AUTOFRY from main power.

Verify the line voltage.

The *AUTOFRY* will give the appearance of operating if connected to 115 -120 ACV, however, the fan will operate slowly and the heater will not be able to heat the oil.

There will be a display at the keypad.

By-pass or "Jump" the safety circuit.

This will eliminate any safety-related problem.

Inspect all wiring to and from the MDR.

Inspect the circuit board connections.

Visually inspect the circuit board for damage or burned or scorched components.

Inspect the heater plug and cable for excessive grease build up and for any visual damage.

Remove the wire food basket from the cook chamber.

Removing the wire food basket will ease access to the oil pot and heater box assembly.

Ensure that the oil pot is filled to the cold fill line (approximately 2" below the top edge of the pot).

Test the heater box assembly for continuity at the heater I EC socket. (See figure-4)



resistance here.

Clean the IEC socket of any and all accumulated oil.

Inspect the interior of the heater box for shorted, loose or damaged wires and connections.

Check for any signs of immersion and dry all connections as necessary. Re-set the high limit.

Install the heater box onto the oil pot.

Plug the RTD or Thermocouple plug into its socket at the bottom of the heater box assembly.

Install meter probes into the heater plug line and neutral connections.

Set meter to ACV.

Plug the AUTOFRY into main power.

The fan will come on.

The MDR will energize.

There will be line voltage at the heater plug.

After 12 seconds there should be a display at the keypad of current oil temperature.

Re-connect the heater plug to the heater box and verify that the oil is heating. Allow the oil to reach it's ready temp. and verify that the MDR coil de-energizes. Perform a few cook cycles.

Re-install the wire food basket and live test the AUTOFRY with product to ensure the unit functions.

Return the safety circuit to its normal operating mode and re-start the AUTOFRY.

AUTOFRY Model MTI-5 Heater Circuit Overview:

The MTI-5 heater circuit operated in the same manner as the MTI-10 and MTI-40 models to heat the oil. The only substantial differences are, Element Wattages. Heater Box Mounting. Heater Box Configuration.

NOTE: There is a Main ON/OFF switch on the right side of the Model MTI-5.

Ensure this switch is in the marked ON position.

MTI-5 Heater Circuit Wiring Diagram



Main power through the ON/OFF switch is connected to the MDR or **Power Contactor. The thermocouple** circuit, controlled at the circuit board, reads oil temperature and will energize the contactor coil to close the contacts and supply line voltage to the heater.

The Set-point is 352° F MAX. There for any time oil temperature is below 354° The contacts and coil will be energized to supply the heater.

The safety circuit and thermocouple circuit must be closed in order for this circuit to operate.

The manual re-set limit must - also be closed for this circuit to operate.

Error Codes: *A05: Oil temperature has not reached set point with in 16 min. 49 sec.* 

Troubleshoot:

Low voltage: Check supply voltage.

Dead leg: Check power supply voltage ground to line & ground to neutral. Check main ON/OFF switch.

High limit tripped: Re-set limit by pressing red button at the bottom of the heater box.

Heater box not firmly seated on the platform: Re-seat heater box.

Heater plug has slipped down: Loosen clamp and push plug up until a solid contact is made tighten clamp.

Loose wiring: Check all wiring in the heater box.

Loose wiring: Check all wiring from the contactor to the heater supply plug.

A07: Frequency Conflict

Troubleshoot:

Check harmonization of Thermocouple leads. Yellow to Yellow and Red to Red at the thermocouple plug and socket.

Ensure that thermocouple wiring at circuit board is yellow to top terminal and red to lower terminal.

Check thermocouple extension lead for short or break.

A 08: Temperature difference of 50 degrees in 5 second.

Troubleshoot:

Check oil level. Press OFF at keypad then re-start. *Prb: Open thermocouple circuit.* 

Troubleshoot:

Check wiring. Check thermocouple extension lead for short or break. Check that heater box is firmly seated. Check probe. Replace if defective. Testing the Heater Circuit:

After checking for main power and that the main ON /OFF switch is on press the high limit re-set, this may be the only problem. If this does not fix the problem perform a continuity test across the heater socket prongs. If there is no continuity open the heater box and test and inspect the wiring, high limit and heater element. Replace parts as necessary.

If the heater box assembly checks out in good working condition the follow these steps.

The first step will be to jump the safety circuit, after installing the jumper at J3 remove the basket, oil pot and heater box. Install a thermocouple simulator to the thermocouple plug and set it at any temperature below 350° F this will allow the heater circuit to energize. Install a meter set at AC Volts into the heater supply plug.

Press the start button at the keypad.

There should be line voltage at the heater plug if there is not you will need to trace the heater line back as far as necessary to find the interruption of power.

If there is power at the plug but when installed, the heater does not heat, check that the plug and the socket make secure contact.

Live test the AUTOFRY to ensure that the heater heats. Then remove the jumper from J3, re-install the safety circuit and all panels.

AUTOFRY Model MTI-5 Heater Circuit Overview:

The MTI-5 heater circuit operated in the same manner as the MTI-10 and MTI-40 models to heat the oil. The only substantial differences are, Element Wattages. Heater Box Mounting. Heater Box Configuration.

NOTE: There is a Main ON/OFF switch on the right side of the Model MTI-5. Ensure this switch is in the marked ON position.

#### MTI-5 Heater Circuit Wiring Diagram

Main power through the ON/OFF switch is connected to the MDR or Power Contactor. The thermocouple circuit, controlled at the circuit board, reads oil temperature and will



energize the contactor coil to close the contacts and supply line voltage to the heater.

The Set-point is 352° F MAX. There for any time oil temperature is below 354° The contacts and coil will be energized to supply the heater.

The safety circuit and thermocouple circuit must be closed in order for this circuit to operate. The manual re-set limit must also be closed for this circuit to operate.

# AUTOFRY Model MTI-5 Heater Circuit Addendum to the TSM

Heater Platform and Plugs:



The heater box assembly mounts in the AUTOFRY on a platform that has the fixed mounted heater supply plug and the thermocouple plug.

Access to the wiring for this platform **can be made by** removing the small access panel at the left side

of the AUTOFRY and from the rear of the AUTOFRY by removing the rear access panel.



The heater plug and cord assembly is secured into place with a clamp that is screwed through the platform. It is possible for this clamp to loosen and the resulting in poor contact or no contact between the plug and the socket on the bottom of the heater box assembly resulting in a no heat or sporadic heating condition.

# AUTOFRY Model MTI-5 Heater Circuit Addendum to the TSM

Heater Box Assembly:



The matting sockets are on the bottom side of the heater box assembly.

The illustration to the left shows the sockets and probes. The high limit reset button is located in the center of the box.

The heater box is aligned and secured into position by placing the key-hole slots



on the upper flange over the two mounting buttons located on the side wall above the platform.

Push down to secure the connections between the heater and thermocouple plug and sockets.

If a secure connection is not made the display at the keypad will read Prb or AO7 or AO8.

### AUTOFRY Model MTI-5 Heater Circuit Addendum to the TSM

Error Codes: *A05: OH temperature has not reached set point with in 16 min. 49 sec.* 

Troubleshoot:

Low voltage: Check supply voltage.

Dead leg: Check power supply voltage ground to line & ground to neutral. Check main ON/OFF switch.

High limit tripped: Re-set limit by pressing red button at the bottom of the heater box.

Heater box not firmly seated on the platform: Re-seat heater box.

Heater plug has slipped down: Loosen clamp and push plug up until a solid contact is made tighten clamp.

Loose wiring: Check all wiring in the heater box.

Loose wiring: Check all wiring from the contactor to the heater supply plug.

A07: Frequency Conflict

Troubleshoot:

Check harmonization of Thermocouple leads. Yellow to Yellow and Red to Red at the thermocouple plug and socket.

Ensure that thermocouple wiring at circuit board is yellow to top terminal and red to lower terminal.

Check thermocouple extension lead for short or break.

A08: Temperature difference of 50 degrees in 5 second.

Troubleshoot:

Check oil level. Press OFF at keypad then re-start. *Prb: Open thermocouple circuit.* 

Troubleshoot:

Check wiring. Check thermocouple extension lead for short or break. Check that heater box is firmly seated. Check probe. Replace if defective.

# AUTOFRY Model MTI-5 Heater Circuit Addendum to the TSM

Testing the Heater Circuit:

After checking for main power and that the main ON /OFF switch is on press the high limit re-set, this may be the only problem. If this does not fix the problem perform a continuity test across the heater socket prongs. If there is no continuity open the heater box and test and inspect the wiring, high limit and heater element. Replace parts as necessary.

If the heater box assembly checks out in good working condition the follow these steps.

The first step will be to jump the safety circuit, after installing the jumper at J3 remove the basket, oil pot and heater box.

Install a thermocouple simulator to the thermocouple plug and set it at any

temperature below 350° F this will allow the heater circuit to energize.

Install a meter set at AC Volts into the heater supply plug.

Press the start button at the keypad.

There should be line voltage at the heater plug if there is not you will need to trace the heater line back as far as necessary to find the interruption of power.

If there is power at the plug but when installed, the heater does not heat, check that the plug and the socket make secure contact.

Live test the AUTOFRY to ensure that the heater heats. Then remove the jumper from J3, re-install the safety circuit and all panels.

AUTOFRY Model MTI-40 Heater Circuit

The model MTI-40 Electric **AUTOFRY** is manufactures in either 240 Volt three-phase or 240 Volt AC single-phase, (consult the ID tag located at the left side of the appliance for specific ratings).



Figure - 1 MTI-40 Single - Phase wiring





Models with serial numbers <u>1110-40 and lower</u> use a heater pivot bracket that allows the elements to be lifted out of the oil vat. These heater assemblies are equipped with a mercury tilt switch that will deenergize the contactor coil when the element is lifted out of the oil vat.

The high limit used in these models is a manual re-set rated at 450° F. Unlike the models MTI-5 and MTI-10 the high limit is wired at the coil of the power contactor and not directly in line with main power, this is due to electrical ratings. The capillary bulb is fixed in place through a bulkhead fitting in the oil vat. The re-set for this limit is located inside the main door at a panel just below the oil vat. Also located on this panel in the oil pump on off switch.



(Serial Numbers 1110-40 and Lower)

For MTI-40E models, serial numbers 1111-40 and higher, the heater elements are mounted directly to the oil pot deck and do not pivot out of the oil. The high limit is a 450° F automatic reset type. The capillary tube, mounted to the element bars, is held in place with a bracket that wraps around the elements bars. There must be some allowance for play in the capillary tube to prevent the tube from breaking as the element flexes during operation.



Figure - 4 MTI-40 Heater and High Limit Mounting

(Serial Numbers 1111 -40 and Higher)

Each element housing consists of three separate resistors, although it is possible for the MTI-40 to heat with one or more bad resistors efficiency will be compromised.

To trouble shoot a bad resistor begin by verifying amperage draw.

- 1. With *6000-watt* elements (12000-watts total) at **240** *Vac Single-phase* the amperage draw should be **50.00** (+/-).
- 2. With *6000-watt* elements (12000-watts total) at **240** *Vac Three-phase* the amperage draw should total **28.90** (+/-).
- 3. With *8000-watt* elements (16000-watts total) at **240** *Vac Single-phase* the amperage draw should total **66.66** (+/-).
- 4. With *8000-watt* elements (16000-watts total) at **240** *Vac Three-phase* the amperage draw should total **38.53** (+/-).

Using a test meter check across each of the element resistor leads to locate any dead resistor then replace the elements if necessary. Replacement of the entire pivot bracket assembly is suggested for models equipped with that part.

The automatic re-set limit thermostats will trip at 450°F and re-set after cooling 50° F. Coil voltage at the power contactor will be de-energized if the limit has tripped.

Nuisance trips can be caused by a limit that is in too close contact with the element sheaths. If this is the case, simply move the capillary tube off the element, however, NEVER remove the limits from the circuit. Excessive build up

Any open safety will de-energize the heater coils at the power contactors. This should not be confused with an open high limit or a failed heater. An open safety will be displayed at the keypad as **Sft.** Were as if the *AUTOFRY does* not reach its ready temperature with-in 16 minutes and 49 seconds the display at the keypad will be **A05**.

MTI-40 Three Phase to Single Phase Conversion

Parts Required Single Phase Power Contactors I.D. Plate with Serial Number Electrical service will need to be changed. The single-phase requirements are 240 V ac Dedicated Grounded Circuit. 50 Amps with 2-6kW elements, 67 Amps with 2-8 kW elements.

#### Instructions:

- 1. Disconnect the AUTOFRY from Main Power.
- 2. Remove the rear access panel.
- 3. Disconnect the heater leads from the bottom terminals of the power contactors
- 4. Disconnect the coil leads from the power contactors
- 5. Disconnect the power supply leads from the top terminals of the power contactors
- 6. Remove the three-phase power contactors
- 7. Remove the RED leads from the main terminal block
- 8. Remove the NEMA 15-50 Plug Cap from the main power cord.
- 9. Cut-back the RED wire from the supply cord so that it will not be accidentally

# connected or...

10. Install a new three-wire supply cord for hard wire hook-up.



AUTOFRY Model MTI-40 Phase Conversion Instructions

Figure 1 - Three Phase Contactor Preparation for Single-Phase

conversion:

Separate the element led wires. With a meter locate and mark the resistor leads as shown in Figure 2 below. Each heater has three elements resistors there are six wires total for each heater.

Figure 2 shows the wiring diagram for both the three-phase and the single-phase models



Figure 2 – Wiring Diagram

# Make the conversion:

- 1. Install the new single-phase power contactors.
- 2. Attach the separated heater leads to the **Bottom poles** of the contactors.
- 3. Re-attach the coil leads to the single-phase contactors.
- 4. Attach the power supply (White or Blue and Black or Brown wires) to the Top of the single-phase contactors.
- 5. If Necessary: Install the new power supply to the terminal block.



Figure 3 - Single Phase Contactor

AUTOFRY Model MTI-40 Phase Conversion Instructions

To convert the MTI-40 from single-phase to three-phase follow these instructions.

This conversion will require the following parts; Two three-phase power contactors Three-phase terminal block to contactor wire assembly. I.D tag with serial number.

- 4-Wire 6' power-supply cord with NEMA 15-50 Plug.
  - 1. Disconnect the AUTOFRY from Main Power.
  - 2. Remove the rear access panel.
  - 3. Disconnect the heater leads from the bottom terminals of the power contactors
  - 4. Disconnect the coil leads from the power contactors
  - 5. Disconnect the power supply leads from the bottom terminals of the power contactors
  - 6. Remove the single-phase power contactors
  - 7. Remove the power supply cord and replace it with the new 4-wire cord and plug.
  - 8. Install the red terminal block to power contactor wire assembly securing it in place with the existing wire harness cable clamps.



With a meter locate and mark the element resistor leads as shown below and connect them to the new three-phase power contactor as shown in the wiring diagram below.



Figure 5 - Wiring Diagrams

# AUTOFRY Model MTI-40 Phase Conversion Instructions

# Make the conversion

- 1. Install the new three-phase power contactor, note the arrow locations indicating UP.
- 2. Connect the element resistor leads as follows, R11 to R32, R21 to R12 and R31 to R22. (see figure 5 and figure 6) then connect each set of leads to the bottom terminals at the three-phase power contactor.
- 3. Re attach the coil leads to the three-phase contactors
- 4. Attach the power supply leads including the new red leads to the top terminals of the contactor.
- 5. Install the new power supply cord and plug to the terminal block. Ensure that the green ground wire is securely attached to the appliance chassis.



#### INSTALLATION OF HIGH LIMIT BRACKET ON THE MTI-40

#### **REQUIRED PARTS AND TOOLS**

- High Limit Bracket
- Phillips Head Screwdriver
- Pliers

#### PROCEDURE

- 1. Make sure the AUTOFRY is turned off and the oil is cool
- 2. Remove the HEATER ELEMENT from the AUTOFRY. Wipe off any excess oil from the Heater Element.
- 3. Using a Phillips Head Screwdriver, unscrew and remove the METAL BAND that holds the High Limit Probe to the Heater Element. Dispose of the metal band and screw.
- 4. Using your fingers, bend the HIGH LIMIT wire up so it is out of the way. Your Heater Element should appear as in Figure 1.



Figure 1

5. Place the HIGH LIMIT BRACKET around the Heater Element Bar (see Fig.2)



Figure 2

6. Using you fingers, bend ONE ARM of the High Limit Bracket over the Heater Element Bar (see Fig. 3).





7. Using the pliers, squeeze the ARM of the High Limit Bracket so That it is tight around the Heater Element Bar (see Fig 4).



Figure 4 8. Repeat steps 6 and 7 with the OTHER ARM of the High Limit Bracket. When you are finished, the Bracket should appear as in Figure 5.





9. Using your fingers, guide the HIGH LIMIT tube through the holes of the High Limit bracket. When you are finished, it should appear as in Figure 6.



Figure 6

10. The procedure is complete. Put the Heater Element Box back into the AUTOFRY. You are now ready to begin cooking.

# AUTOFRY Models FFG-10 and MTI-10 Branch Circuit





Branch Circuit power will be supplied to the circuit board as long as the main power is connected. There is no true off.



The branch circuit is the power supply for the circuit board. It is comprised of the following components.

- 1. Power supply from the MDR (Mercury Displacement Relay)
- 2. The Transformer 240 ACV Primary and 24 ACV CT (Center Tapped) Secondary.
- 3. An EMI (Electromagnetic Interference) Filter
- 4. 2, Class CC 1/2 amp. ACV fuses and their holders (primary side).
- 5. 2, 3 amp glass fuses (secondary side).
- 6. Models FFG-10 will utilize 1/2 amp circuit breakers these may be mounted externally or internally depending of the date of manufacture. These breakers, if defective, should be replaced.

Fuses on the primary side of the transformer must be replaced with exact replacements.

Symptoms of Fuse Failure:

No audible tone from the circuit board when the AUTOFRY is connected to main power.

No response at the circuit board and or keypad when the ON key at the key pad is pressed.

No response from the exhaust fan.

Inspect the following:

Remove the caps from the fuse holders, remove the fuses and check them, with a meter, for continuity.

• If the fuses fail replace them with similar parts.



VERY IMPORTANT: The Class CC fuses must be installed with the Nipple end into the fuse holder body first. As shown in figure 2.

Verify that there is voltage at the wall socket. (230 ACV).

Verify continuity from the power plug to the MDR (Mercury Displacement Relay) Verify that the

connections from the MDR to the transformer are made.

Inspect the soldered connections at both the primary and secondary sides of the transformer.

## AUTOFRY Models FFG-10 and MTI-10 Branch Circuit

Check for line voltage at the following locations.

**NOTE:** With the exception RTD circuit all blue and brown wires should be carrying line voltage.

- 1. At the MDR line in.
- 2. At the MDR line out to the transformer (# 18 GA. blue and Brown Wires).
- 3. At the transformer primary connections (#18 GA, Blue and Brown wires).
- 4. At both sides of the EMI filter (Line and Load).
- 5. At the fuse holder connections.



If there is voltage throughout the primary side of the circuit, inspect the secondary side.

1. From the center tap at the transformer (# 18 GA. Orange wire) to either of the two yellow wires there should be 12-14 Volts AC supplying the circuit board.

2. Across both yellow wire there should be 24 (+/-2-5) VAC Inspect the 7-pin plug at the lower right hand corner of the circuit board.

Ensure that all connections are secure and that there is no visible snorting.

3. Inspect the traces at the back of the circuit board for burning.

If there are any signs of burning at these locations at the circuit board, the board will need to be replaced.

Please read all these instructions prior to performing this up-grade. This up-grade will take between 1/2. to 1 hour to complete.

Parts included with this up-grade are as follows:

Qty	Part#	Description.
1	10051K	NCC Display Board
1	10050K	Ribbon Cable
1	10079K	NCC Control Board
1	WK-Cable	Thermocouple Wire and Plug Assembly

# NOTE:

In addition to these parts a new heater box assembly equipped with a "K" Type thermocouple will need to be installed.

- For FFG-10 models the heater element wattage must be 208 Volt 3750 Watts. (Part# 10064-K31)
- For MTI-10 models the heater element wattage can be either 208 Volt 3750 Watt (Part # 10064-K31) or 240 Volt 3700 Watts (Part # 10064-K32). Check the Voltage rating on the equipment ID tag.

A 240 Volt 4800 Watt heater box assembly (Part # 10064-K4) is available, however, the electrical service must support the increased amperage. Additionally, the equipment plug and outlet may need to be changed to NEMA 6-30.

The identification tag, located on the back lower left-hand corner of the unit (just above the power cord) will also need to be changed. This ID tag will need to reflect the new specification changes. Please supply the following information, from the old ID tag, to our service department prior to ordering the Up-grade

Model Number, serial number, Date of MFG

The ID tag is secured with 4 1/8" stainless steel rivets. Remove these rivets and secure the new ID plate.

Before beginning this Up-grade be sure to disconnect the AUTOFRY from all power supplies.

# At the front of the fryer.

- 1. From the interior cook chamber of the MTI-10 or FFG-10 remove the existing heater box assembly.
- 2. Cut the RTD plug from its cable. The RTD plug is the smaller of the two plugs located within the cook chamber.
- 3. Install the new heater box onto the oil pot.
- 4. Remove the 4 screws securing the Key Pad frame.
- 5. Disconnect the existing keypad from the ribbon cable
- 6. Connect the new ribbon cable to the new keypad
- 7. Snake the ribbon cable through the conduit tube.
- 8. Loosely secure the keypad to the front of the fryer.

# Remove the rear access panel from the fryer.

With the exception of the ribbon cable and the thermocouple extension wire this is a wire for wire up-grade.

- 1. Remove the old ribbon cable from the conduit tube and disconnect it from the MEC control board.
- 2. Pull the new ribbon cable through the conduit tube.
- 3. Mark all wires according to figure 1 prior to disconnection Starting at the upper left

hand corner of the MEC Controller (see Figure 1).

- A. Mark the first set of black and red wires J2
- B. Mark the second set of black and red wires J3

- C. At the middle of the right side of the control board remove the blue and brown wires. This entire RTD wire assembly from the control board to the heater box will be replaced with the thermocouple wire and plug assembly (Part # 10K-Cable).
- D. At the lower right hand corner of the control board mark the six pin plug J10
- E. At the lower left hand comer of the control board there are six wires screwed into a white terminal block.

Marking from right to left..

- 1. Mark the first blue and brown wires J9
- 2. Mark the middle blue and brown wires J8
- 3. Mark the last blue and brown wires J7

Disconnect all the wires and remove the MEC control board.

• Only the wires at the white terminal block need to be un-screwed. The other 4 connections are removable plugs.

Remove the MEC control board from the standoffs.

Securely install the NCC control board onto the standoffs.

Making the new connections (see Fig. 2)

#### 1. Plug the new ribbon cable into its socket marked J1 on the control board

- 2. Plug the black and red wires marked J2 into the socket marked J2 on the control board.
- 3. Plug the black and red wires marked J3 into the socket marked J3 on the control board.
- 4. Plug the wires marked J10 into the socket marked J10 on the control board.

At the lower left hand corner of the control board there are three sets of two screw terminals (see fig. 2). Secure the following wires to there respective terminals

- A. Secure the blue and brown wires marked J9 into the terminals marked J9.
- B. Secure the blue and brown wires marked J8 into the terminal marked J8.
- C. Secure the last two blue and brown wires marked J7 into the terminal marked J7.



FIGURE 1 -- Mark all wires.



# The basket motor polarity must be reversed.

At the basket motor power terminals switch the white from the negative to positive and the white with the black strip from the positive to the negative.



# Removing the RTD cables and installing the Thermocouple Wires

- 1. Loosen all the cable clamps used to secure the RTD wires and cable to the old control board.
- 2. Remove all the RTD cables by pulling them through the back of the AUTOFRY.
- 3. Check the condition of the small rubber grommet used to protect this cable. If the grommet is missing or if the condition is deteriorated, replace it.
- 4. From the front of the AUTOFRY route the new thermocouple cable assembly, terminal ends first, through the rubber grommet and then through to the control board.

Ensure there is enough slack in the cable so that it can be plugged easily into its socket at the bottom of the new heater box assembly.

1. Connect the yellow thermocouple lead to the top terminal marked TC1 on the control board.

2. Connect the red thermocouple lead to the bottom terminal marked TC1 on the control board.

If these connections are reversed the controller will display and erroneous oil temperature, the error message Prb or A07 will appear at the keypad.

3. Secure the wire leads to the cable clamps.

Insure that the cable assembly will not pull loose from the control board. Loop the cable around the cable clamps to ensure they will not pull loose.

Test the controller

- 1. Install the heater box onto the oil pot.
- 2. Ensure there is oil in the oil pot.
- 3. Plug the yellow thermocouple plug into its socket at the bottom of the heater box.

Make sure to install the plug correctly, the large prong goes into the large hole on the socket and the small prong goes into the small hole (See fig 4.)



Figure 4

- 4. Plug the heater plug into its socket at the bottom of the heater box
- 5. Plug the AUTOFRY into the main power.
- 6. Close the main door of the AUTOFRY
- 7. Press the ON key at the keypad.
- 8. Monitor the oil temperature displayed at the keypad, to ensure the AUTOFRY is heating

After verifying that the oil is heating press the OFF key at the keypad and secure the keypad to the front of the AUTOFRY using the keypad frame. Secure the rear panel.

Carefully package the following items for return to the factory:

- 1. MEC control board
- 2. Keypad
- 3. Ribbon Cable
- 4. Heater box assembly.

Return Address:

Motion Technology Inc. Attn. Service Department 6 Huron Dr. Natick, MA01760

## AUTOFRY Models FFG-10, MTI-5, MTI-10 & MTI-40 Programming

**Circuit Board Programming** 

All **AUTOFRY** control boards contain programs for various temperature and basket functions. These programs have been set at the factory; however, there may be occasions when these program setting may need adjustments or changes.

The **AUTOFRY** has utilized two types of controllers they are, the Milwaukee controller and the NCC controller. The Milwaukee controller may also have been equipped with a 12R3 epprom.

Milwaukee Circuit boards (part # 10079)

FFG-10: All serial numbers ending in -A. MTI-10: Serial numbers 4890-10 through 6553-10. MTI-40: Serial numbers 1000-40 through 1064-40.

NCC circuit boards (part # 10079K)

MTI-10: Serial numbers 6554-10 to present. MTI-40: Serial numbers 1065-40 through present. MTI-5: Serial numbers 2000-5 through present.

The quickest way to determine what controller or which epprom is installed is as follows,

At the keypad,

- 1. Press the OFF key.
- 2. Press the 2 and 0 key simultaneously.
  - If there is no display the Milwaukee controller is installed with a 10F or 10C epprom.
  - If the display read 001 the Milwaukee controller with the 12R3 epprom is installed.
  - If the display read P= the NCC controller is installed.

The 12R3 epprom and the NCC controller allow for up-front programming. For the Milwaukee controller with the 10F or 10C epprom access to the control board will be necessary to remove a "jumper" cap on the board.

The Milwaukee controller temperature program values are in Celsius. To gain access to the 12R3 epprom,

- Press the OFF key.
- Press the 2 + 0 Keys The display reads 001.
- To scroll through the programs press the 2 key to move *UP* or press the 3 key to move *DOWN*.
- Press the 1 key to enter the program and display the current value.

	MTI Rat 10079	Controller MTI-10	/alues (1-612R3 ONLY)	• Press the 2 key to raise the value or
Program#	Value	Range	Description	- • Press the 3 key to
1	1:00	0:05-9:99	Cook Time 1	
2	2:00	0:05-9:99	Cook Time 2	Bross the 1 key to
3	3:00	0:05-9:99	Cook Time 3	
4	4:00	0:05-9:99	Cook Time 4	save the <b>changes</b> .
5	5:00	0:05-9:99	CookTime 5	
6	6:00	0:05-9:99	Cook Time 6	• To exit
7	179	143-215	Ready/Temp.	programming press the
8	150	1-250	Stand-by Terrp.	OFF key.
9	001	0:01-0:06	Hysterisis	
10	016	1-999	Bastet Cook to Drain Time	
11	120	1-999	Basket Grain Tims	
12	066	1-250	Fan Off Temp.	
13	999	Х	HeaterTime Out to A05	
14	003	1-999	Stat - Cook Basket time	
15	032	1-999	Basket Drain to Dump Time	
16	999	Х	Heater- "Time Out to A05	
17	010	1-200	Motor time out to A04	
18	0:00	0-999	Oil change counter	



The arrow points to the Jumper cap located at SW1. This cap will need to be removed to gain access to the programming function for the Milwaukee controllers with the 10F and 10C epprom.

After removing this cap the display will read 001. Follow instructions for scrolling and entering programs.

After programming the cap MUST be replaced on the two prongs closest to the arrow.

### AUTOFRY Models FFG-10, MTI-5, MTI-10 & MTI-40 Programming

Programs for the NCC controler are listed below. There are two password levels for the NCC controler.

- 1. The use password level.
  - · Gains access to the six pre-programmed cook times ONLY.
- 2. The advanced password level.
  - · Gains access to all programs.

To enter advanced programming,

- Press the **OFF** Key.
- Press 2+0 Keys Display will read P= •
- Press 1,9,8,0. •
- Press START • Display will read 001

To enter user programming,

- Press the **OFF** Key ٠
- Press 2+0 Keys Display reads P=
- Press 2,2,2 Display will read **001**.

-

To scroll the	r MT1-10 Values	t 10079K Controle	Mn Par	
	Description	Range	Value	Program #
programs pr	Cook Time 1	0:05-15:59	1:00	1
key to move	Cook Time 2	0:05-15:60	2:00	2
press the 3 k	Cook Time 3	0:05-15:61	3:00	3
DOWN.	Cook Time 4	0:05-15:62	4:00	4
	Cook Time 5	0:05-15:63	5:00	5
Press the 1	Cook Time 6	0:05-15:64	6:00	6
enter the pro	Ready Temp.	100-375	354	7
display the c	Stand-by Temp.	1-250	302	8
value	Hysterisis	0:01-0:06	2	9
Value.	Basket Cook to Drain Time	1-999	14	10
Press the 2	Basket Drain Time	1-999	120	11
the value or	Fan Off Temp.	1-250	151	12
kov to lower	Heater Time Out to A05	Х	999	13
key to lower	Start - Cook Basket time	1-999	2	14
Droop the	Basket Drain to Dump Time	1-999	20	15
riess life	Heater Time Out to A05	Х	999	16
	Motor time out to A04	1-200	10	17
	Dead Beat Lock-Up Counter A06	0-999	0:00	18
	Basket Dump to Drain Time	1-999	10	19
OFF Key.	Ready Light Mn. temp.	1-250	340	20
]	Ready Light Max. Temp.	1-250	392	21
]	New Password (User)	1-999	NP=	22
]	F or C Temperature Display	C or F	5F	23
-				

rough ess the 2 UP or ey to move

key to gram and urrent

key to raise Press the 3 the value.

1 key to nges. g press the

## AUTOFRY Models FFG-10, MTI-5, MTI-10 & MTI-40 Programming

Program #	Value	Range	Description
1	1:00	0:05- 15:59	Cook Time 1
2	2:00	0:05- 15:60	Cook Time 2
3	3:00	0:05- 15:61	Cook Time 3
4	4:00	0:05- 15:62	Cook Time 4
5	5:00	0:05- 15:63	Cook Time 5
6	6:00	0:05- 15:64	Cook Time 6
7	354	100-375	Ready Temp.
8	302	1-250	Stand-by Temp.
9	2	0:01-0:06	Hysterisis
10	015	1-999	Basket Cook to Drain Time
11	120	1-999	Basket Drain Time
12	151	1-250	Fan Off Temp.
13	999	Х	Heater Time Out to A05
14	003	1-999	Start - Cook Basket time
15	020	1-999	Basket Drain to Dump Time
16	999	Х	Heater Time Out to A05
17	10	1-200	Motor time out to A04
18	0:00	0-999	Dead Beat Lock-Up Counter A06
19	010	1-999	Basket Dump to Drain Time
20	340	1-250	Ready Light f.lin. temp.
21	392	1-250	Ready Light Max. Temp.
22	NP=	1-999	New Password (User)
23	5 F	CorF	F or C Tempera:ure Display

MTI Part 10079K Controller MTI-40 Values

	MTt Part 10079K Controler MTI-5 Values										
Program #	Value	Range	Description								
1	1:00	0:05- 15:59	Cook T—,e 1								
2	2:00	0:05- 15:60	Cook Time 2								
3	3:00	0:05- 15:61	Cook Time 3								
4	4:00	0:05- 15:62	Cook Time 4								
5	5:00	0:05- 15:63	Cook Time 5								
6	6:00	0:05- 15:64	Cook Time 6								
7	354	100-375	Ready Temp.								
8	302	1-250	Stand-by Temp.								
9	002	0:01-0:06	Hysterisis								
10	012	1-999	Basket Cook to Drain Time								
11	120	1-999	Basket Drain Time								
12	151	1-250	Fan Off Temp.								
13	999	Х	Heater Time Out to A05								
14	002	1-999	Start - Cook Basket time								
15	013	1-999	Basket Drain to Dump Time								
16	999	Х	Heater Time Out to A05								
17	010	1-200	Motor time out to A04								
18	0:00	0-999	Dead Beat Lock-Up Counter A06								
19	012	1-999	Basket Dump to Drain Time								
20	340	1-250	Ready Light Min. temp.								
21	392	1-250	Ready Light Max. Temp.								
22	NP=	1-999	New Password (User)								
23	5F	C or F	F or C Temperature Display								

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# AUTOFRY TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	SOLUTION
UNIT WILL NOT TURN ON	UNIT NOT PLUGGED IN MAIN CIRCUIT BREAKER TRIPPED BLOWN FUSES	PLUG UNIT INTO OUTLET CHECK MAIN CIRCUIT BREAKER REPLACE FUSES
UNIT STARTS UP - THEN AN "SFT" IS DISPLAYED AT THE KEY PAD	VENT BLOCKED AT TOP FILTERS NOT INSTALLED FRONT DOOR OPENT	CLEAR VENT CHECK ALL FILTERS CLOSE AND LOCK FRONT DOOR
AUTOFRY WILL NOT HEAT UP OR "A05" IS DISPLAYED ON KEYPAD	HIGH LIMIT TRIPPED NO SUPPLY VOLTAGE DID NOT HEAT UP IN 16 MIN	RESET HIGH LIMIT CHECK VOLTAGE AT WALL TURN UNIT OFF AND THEN ON
	-	
UNABLE TO ENTER A COOK TIME ON KEYPAD	AUTOFRY IN "STANDBY" AUTOFRY IN "WAIT"	PRESS "CLEAR" ON THE KEYPAD WAIT FOR THE "READY" LIGHT BEFORE ENTERING MORE PRODUCT UNPLUG AND RE-PLUG
"Prb", "A07", "A08", OR "716" APPEARS ON KEYPAD	YELLOW THERMOCOUPLE PLUG IN NOT INSTALLED YELLOW THERMOCOUPLE PLUG IS INSTALLED BACKWARDS	INSTALL THERMOCOUPLE PLUG UNPLUG THERMOCOUPLE PLUG AND REINSTALL CORRECTLY
"A04" ON KEYPAD	BASKET IS JAMMED	REMOVE AND RE-INSTALL BASKET UNPLUG AND RE-PLUG POWER CORD
POWER FAILURE IN THE STORE AND THE AUTOFRY WILL NOT COME BACK ON	AUTOFRY ENTERED "STANDBY" MODE KEYPAD WON'T OPERATE	PRESS "CLEAR" ON KEYPAD UNPLUG AND RE-PLUG POWER CORD
PRODUCT DOES NOT COME OUT OF THE AUTOFRY AT THE END OF THE COOK TIME	BASKET NOT INSTALLED BASKET NOT INSTALLED CORRECTLY PRODUCT ENTERED BEFORE "READY" LIGHT WAS ON	INSTALL BASKET REMOVE AND INSTALL BASKET WAIT FOR THE "READY" LIGHT TO COME ON BEFORE ENTERING PRODUCT
L	1	

IF PROBLEM STILL PERSISTS CALL FOR SERVICE AT 1-800-348-2976 THEN PRESS 112 OR 0 AND EXPLAIN THE PROBLEM TO THE OPERATOR.

THE SERVICE TECHNICIAN WILL ALWAYS ATTEMPT TO CORRECT THE PROBLEM OVER THE TELEPHONE. IF THIS IS NOT POSSIBLE A SERVICE COMPANY IN YOUR AREA WILL BE CONTACTED AND DISPATCHED TO YOUR LOCATION. FOR EMERGENCY SERVICE AFTER HOURS OR ON WEEKENDS ONLY CALL 1-888-664-6640.

ANY UNAUTHORIZED SERVICE ON THE AUTOFRY MAY VOID THE WARRANTY

Error Codes

### AUTOFRY Models FFG-10, MTI-5, MTI-10 MTI-40

				Error	Codes	
	EPROM					
10F	10C	12R3	NCC	Fault/ Condition	Troubleshoot	To clear display and re-set
417	213	A02	Prb	Open or shorted RTD or Thermocouple Probe	Check plugs & sockets. Check arobe. Check condition of all cords and connections, (see also A07)	Un-plug from supply or press OFF
Blank Display w Fan On	Blank Display w Fan On	A03	Sft	Open Safety	Check all safeties, check fan operation, check fire system gauge, check filter installations. Check / adjust air flow switch.	Press OFF
A04	A04 A04 A04 A04		Basket motor not in position after 10 seconds	Check for broken gears, check all wire connections, check switches, check switch cam tightness.	Un-plug from supply or press OFF	
A05	A05	A05	A05	Heater failure to reach set point in 16 Min. 49 Seconds	Check supply voltage, check supply breaker, check limit re-set, check voltage at heater plug.	Un-plug from supply or press OFF
N/A	N/A	N/A	A06	Dead beat counter alarm	Check outstanding customer balance. Re-set program #018	Press OFF
		A07	Frequency Conflict/ Thermocouple short	Check yellow thermocouple plug installation. Check cord condition. Check connections at TC1 on circuit board. Check connections at thermocouple socket in heater box (yellow = (+), red = (-)	Press OFF	
A		A08	Temperature difference of 50 Deg. In 5 second period.	Check oil level. Check oil condition. Un- plug from wall to clear board.	Press OFF and Un-plug from supply	

NOTE: AO errors should not be confused with cook times. Error codes do not use a colon cook times do. The NCC controller can display cook times of 11 minutes as follows 11:02 = A:02, 11:03 = A:03 11:04 = A:04, 11:05 = A:05, 11:06 = A:06 11:07 = A:07 11:08 = A:08

	To Conve	rt	:	To Conver							
C	C or F	F	С	CorF			To Conver	t		To Conver	
-17.78	0	32	-6.66	20	<u></u> <u>г</u>	С	C or F	F	С	CorF	
	11	33.8	-6.11	21	00	4.45	40	104	15.57	60	<u>г</u>
-16.67	2	35.6	-5.55		09.8	5.01	41	105.8	16.12	61	140
-16.11	3	37.4	-5.00	22	72.4	5.56	42	107.6	16.68	62	141.8
-15.56	4	39.2	-4 44		75.4	6.12	43	109.4	17.23	63	143.0
-15.00	5	41	-3.88	24		6.67	44	111.2	17 79	64	145.4
-14.44	6	42.8	-3 33	25	70.0	7.23	45	113	18 35	65	147.2
-13.89	7	44.6	-2 77	20	/8.8	7.79	46	114.8	18.00	60	149
-13.33	8	46.4	-2.22	21	80.6	8.34	47	116.6	19.46	67	150.8
-12.78	9	48.2	-1.66	20	82.4	8.90	48	118.4	20.01	<u> </u>	152.6
-12.22	10	50	-1 11	29	84.2	9.45	49	120.2	20.01	68	154.4
-11.67	11	51.8	-0.55	30	86	10.01	50	122	21.12	- 69	156.2
-11.11	12	53.6	0.00	31	87.8	10.56	51	123.8	21.12	70	158
-10.55	13	55.4	0.01	32	89.6	11.12	52	125.6	22.00	71	159.8
-10.00	14	57.2	1 12	33	91.4	11.68	53	127.4	22.24		161.6
-9.44	15	59	1.12	34	93.2	12.23	54	129.2	22.79		163.4
-8.89	16	60.8	1.07	35	95	12.79	55	131	23.35		165.2
-8.33	17	62.6	2.23	36	96.8	13.34	56	132.8	23.90	/5	167
-7.78	18	64.4	2.70	37	98.6	13.90	57	134.6	24.40	76	168.8
-7.22	19	66.2	3.34	38	100.4	14.46	58	136 /	25.01	77	170.6
		00.2	3.90	39	102.2	15.01	59	138.2	25.57	78	172.4
								130.2	26.13	79	174.2

	To Convert			To Convert				To Conver	t			To Convert	
С	C or F	F	С	C or F	F		С	C or F	F	1	С	C or F	F
26.68	80	176	37.80	100	212	1	48.91	120	248		60.03	140	284
27.24	81	177.8	38.35	101	213.8		49.47	121	249.8	1	60.58	141	285.8
27.79	82	179.6	38.91	102	215.6		50.02	122	251.6	1	61.14	142	287.6
28.35	83	181.4	39.46	103	217.4		50.58	123	253.4		61.69	143	289.4
28.90	84	183.2	40.02	104	219.2		51.14	124	255.2		62.25	144	291.2
29.46	85	185	40.58	105	221	T	51.69	125	257		62.81	145	293
30.02	86	186.8	41.13	106	222.8		52.25	126	258.8		63.36	146	294.8
30.57	87	188.6	41.69	107	224.6		52.80	127	260.6		63.92	147	296.6
31.13	88	190.4	42.24	108	226.4		<b>53</b> .36	128	262.4		64.47	148	298.4
31.68	89	192.2	42.80	109	228.2		53.91	129	264.2		65.03	149	300.2
32.24	90	194	43.35	110	230		54.47	130	266	1	65.58	150	302
32.80	91	195.8	43.91	111	231.8		55.03	131	267.8		66.14	151	303.8
33.35	92	197.6	44.47	112	233.6		55.58	132	269.6		66.70	152	305.6
33.91	93	199.4	45.02	113	235.4		56.14	133	271.4		67.25	153	307.4
34.46	94	201.2	45.58	114	237.2		56.69	134	273.2		67.81	154	309.2
35.02	95	203	46.13	115	239	1	57.25	135	275		68.36	155	311
35.57	96	204.8	46.69	116	240.8		57.80	136	276.8		68.92	156	312.8
36.13	97	206.6	47.24	117	242.6	1	58.36	137	278.6		69.48	157	314.6
36.69	98	208.4	47.80	118	244.4		58.92	138	280.4		70.03	158	316.4
37.24	99	210.2	48.36	119	246.2		59.47	139	282.2		70.59	159	318.2

	To Convert			••••••	To Convert			Т	o Convei	rt	1	o Convert	
С	C or F	F		С	C or F	F		С	C or F	F	С	C or F	F
71.14	160	320	1	82.26	180	356		93.37	200	392	104.49	220	428
71.70	161	321.8		82.81	181	357.8		93.93	201	393.8	105.04	221	429.8
72.25	162	323.6		83.37	182	359.6		94.48	202	395.6	105.60	222	431.6
72.81	163	325.4	;	83.92	183	361.4		95.04	203	397.4	106.16	223	433.4
73.37	164	327.2		84.48	184	363.2		95.60	204	399.2	106.71	224	435.2
73.92	165	329		85.04	185	365		96.15	205	401	107.27	225	437
74.48	166	330.8		85.59	186	366.8		96.71	206	402.8	107.82	226	438.8
75.03	167	332.6		86.15	187	368.6		97.26	207	404.6	108.38	227	440.6
75.59	168	334.4		86.70	188	370.4		97.82	208	406.4	108.93	228	442.4
76.14	169	336.2		87.26	189	372.2	1	98.37	209	408.2	109.49	229	444.2
76.70	170	338		87.82	190	374		98.93	210	410	110.05	230	446
77.26	171	339.8		88.37	191	375.8		99.49	211	411.8	110.60	231	447.8
77.81	172	341.6		88.93	192	377.6	1	100.04	212	413.6	111.16	232	449.6
78.37	173	343.4		89.48	193	379.4		100.60	213	415.4	111.71	233	451.4
78.92	174	345.2		90.04	194	381.2		101.15	214	417.2	112.27	234	453.2
79.48	175	347		90.59	195	383		101.71	215	419	112.82	235	455
80.03	176	348.8		91.15	196	384.8		102.26	216	420.8	113.38	236	456.8
80.59	177	350.6		91.71	197	386.6		102.82	217	422.6	113.94	237	458.6
81.15	178	352.4		92.26	198	388.4		103.38	218	424.4	114.49	238	460.4
81.70	179	354.2		92.82	199	390.2		103.93	219	426.2	115.05	239	462.2

	To Convert	:		Fo Conver	t	-	To Conve	rt	-	To Conver	t
С	C or F	F	С	C or F	F	С	C or F	F	С	C or F	F
115.60	240	464	126.72	260	500	137.83	280	536	148.95	300	572
116.16	241	465.8	127.27	261	501.8	138.39	281	537.8	149.50	301	573.8
116.71	242	467.6	127.83	262	503.6	138.94	282	539.6	150.06	302	575.6
117.27	243	469.4	128.39	263	505.4	139.50	283	541.4	150.62	303	577.4
117.83	244	471.2	128.94	264	507.2	140.06	284	543.2	151.17	304	579.2
118.38	245	473	129.50	265	509	140.61	285	545	151.73	305	581
118.94	246	474.8	130.05	266	510.8	141.17	286	546.8	152.28	306	582.8
119.49	247	476.6	130.61	267	512.6	141.72	287	548.6	152.84	307	584.6
120.05	248	478.4	131.16	268	514.4	142.28	288	550.4	153.39	308	586.4
120.60	249	480.2	131.72	269	516.2	142.84	289	552.2	153.95	309	588.2
121.16	250	482	132.28	270	518	143.39	290	554	154.51	310	590
121.72	251	483.8	132.83	271	519.8	143.95	291	555.8	155.06	311	591.8
122.27	252	485.6	133.39	272	521.6	144.50	292	557.6	155.62	312	593.6
122.83	253	487.4	133.94	273	523.4	145.06	293	559.4	156.17	313	595.4
123.38	254	489.2	134.50	274	525.2	145.61	294	561.2	156.73	314	597.2
123.94	255	491	135.05	275	527	146.17	295	563	157.28	315	599
124.50	256	492.8	135.61	276	528.8	146.73	296	564.8	157.84	316	600.8
125.05	257	494.6	136.17	277	530.6	147.28	297	566.6	158.40	317	602.6
125.61	258	496.4	136.72	278	532.4	147.84	298	568.4	158.95	318	604.4
126.16	259	498.2	137.28	279	534.2	148.39	299	570.2	159.51	319	606.2

	To Convert		T	o Conver	t		Fo Convert			To Convert	
С	C or F	F	С	C or F	F	С	C or F	F	С	C or F	F
160.06	320	608	171.18	340	644	182.29	360	680	193.41	380	716
160.62	321	609.8	171.73	341	645.8	182.85	361	681.8	193.96	381	717.8
161.18	322	611.6	172.29	342	647.6	183.41	362	683.6	194.52	382	719.6
161.73	323	613.4	172.85	343	649.4	183.96	363	685.4	195.08	383	721.4
162.29	324	615.2	173.40	344	651.2	184.52	364	687.2	195.63	384	723.2
162.84	325	617	173.96	345	653	185.07	365	689	196.19	385	725
163.40	326	618.8	174.51	346	654.8	185.63	366	690.8	196.74	386	726.8
163.95	327	620.6	175.07	347	656.6	186.18	367	692.6	197.30	387	728.6
164.51	328	622.4	175.62	348	658.4	186.74	368	694.4	197.86	388	730.4
165.07	329	624.2	176.18	349	660.2	187.30	369	696.2	198.41	389	732.2
165.62	330	626	176.74	350	662	187.85	370	698	198.97	390	734
166.18	331	627.8	177.29	351	663.8	188.41	371	699.8	199.52	391	735.8
166.73	332	629.6	177.85	352	665.6	188.96	372	701.6	200.08	392	737.6
167.29	333	631.4	178.40	353	667.4	189.52	373	703.4	200.63	393	739.4
167.84	334	633.2	178.96	354	669.2	190.07	374	705.2	201.19	394	741.2
168.40	335	635	179.52	355	671	190.63	375	707	201.75	395	743
168.96	336	636.8	180.07	356	672.8	191.19	376	708.8	202.30	396	744.8
169.51	337	638.6	180.63	357	674.6	191.74	377	710.6	202.86	397	746.6
170.07	338	640.4	181.18	358	676.4	192.30	378	712.4	203.41	398	748.4
170.62	339	642.2	181.74	359	678.2	192.85	379	714.2	203.97	399	750.2

	To Conver	t			To Conver	 f
<u> </u>	C or F	F		С	CorF	
204.52	400	752	1	215.64	420	790
205.08	401	753.8		216.20	421	700
205.64	402	755.6	<u> </u>	216.75	421	709.8
206.19	403	757.4		217.31	422	791.6
206.75	404	759.2		217.86	423	793.4
207.30	405	761		218.42	424	795.2
207.86	406	762.8	-	218.07	425	797
208.41	407	764.6	-	210.97	426	798.8
208.97	408	766.4		219.00	427	800.6
209.53	409	768.2		220.09	428	802.4
210.08	410	770		220.64	429	804.2
210.64	410	771.9		221.20	430	806
211 19	411	772.0		221.75	431	807.8
211.75		775.4		222.31	432	809.6
212.30	413	775.4		222.86	433	811.4
212.00	414	///.2		223.42	434	813.2
212.00	415	//9		223.98	435	815
213.42	416	/80.8		224.53	436	816.8
213.97	41/	782.6		225.09	437	818.6
214.53	418	784.4		225.64	438	820.4
215.08	419	786.2		226.20	439	822.2

Deg C	0.00		Re	sistance va	lues from	Der Ol				
-3.0	100.00	1.00	2.00	3.00	4 00	U Deg C to	+ 199 Deg (	C.		
10	102.00	100.39	100.78	101.17	101 56	5.00	6.00	7.00	8.00	
20	107.70	104.29	104.68	105.07	105.46	101.95	102.34	102.73	103.12	103
30	111.67	108.18	108.57	108.96	109.35	100.85	106.24	106.63	107.02	103.
40	115.541	112.06	112.45	112.84	113 23	112.60	110.13	110.52	110.91	111
50	119.04	115.93	116.31	116.70	117.08	117.02	114.01	114.40	114.79	115
60	123.24	102.00	120.16	120.54	120.92	121.20	117.85	118.24	118.62	119
70	127.07	123.62	124.01	124.39	124.78	125.16	121.68	122.06	122.44	122
80	130.89	131.27	127.84	128.22	128.61	128.99	125.55	125.93	126.32	126
90	134,70	135.08	131.66	132.04	132.43	132.81	129.38	129.76	130.15	130
100	138.63	138.88	135.46	135.84	136.22	136.60	136.00	133.58	133.97	134.:
110	142.29	142.66	142.04	139.56	139.87	140.19	140.54	137.36	137.74	138.
120	146.06	146.44	145.04	143.41	143.79	144.16	144.54	140.82	141.14	141.4
130	149.82	150.20	150.57	147.19	147.56	147.94	148.31	144.91	145.29	145.6
140	153.58	153.95	154.32	150.95	151.32	151.70	152.07	152.45	149.06	149.4
150	157.31	157.69	158.06	154.69	155.06	155.43	155.80	156 17	152.82	153.2
160	161.04	161.42	161.79	108.44	158.81	159.19	159.56	150.17	156.54	156.9
170	164.76	165.13	165 50	102.17	162.54	162.92	163.29	163.67	160.31	160.6
180	168.46	168.83	169.20	160.57	166.24	166.61	166.98	167 35	164.04	164.4
190	172.16	172.53	172.90	173.07	169.94	170.31	170.68	171.05	107.72	168.0
				113.21	173.64	174.01	174.38	174 75	175.40	171.7
									175.12	175.4

Amount of Oil		Temperature Rise Deg. F							
Cubic Feet	Gallons	50 F.	100 F	200 F	300 F	400 F	500 F		
0.5	3.74	0.3	0.5	1	2	2	3		
1	7.48	0.5	1	2	3	4	6		
2	14.96	1	1	2	4	6	11		
3	22.25	2	3	6	9	12	16		
4	29.9	2	4	8	12	16	22		
5	37.4	3	4	9	15	20	25		
10	74.8	5	9	18	29	40	52		
15	112.5	7	14	28	44	60	77		
20	149.6	9	18	37	58	80	102		
25	187	11	22	46	72	100	127		
30	222.5	13	27	56	86	120	151		
35	252	16	31	65	100	139	176		
40	299	18	36	74	115	158	201		
45	336.5	20	40	84	129	178	226		
50	374	22	45	93	144	197	252		
55	412	25	49	102	158	217	276		
60	449	27	54	112	172	236	302		
65	486	29	58	121	186	255	326		
70	524	32	62	130	200	275	350		
75	5fi2	. 34	67	140	215	294	375		

• Read across in table from nearest amount in gallons of liquids to desired temperature rise column and note kilowatts to heat in one hour.

Includes a 20% safety factor to compensate for high heat losses and/or low power voltage.



MTI-10 1 Phase NEMA 6-30 Plug Configuration			
2 Pole 3 Wire Grounding 240 Volt AC	Motion Technology, Inc,		
	6 Huron Drive		
REV 001 6/99	Natick/ MAO 1760		



MTI-5 & 10 1 Phase NEMA 6-20 Plug Configuration	
Pole 3 Wire Grounding 240 Volt AC	Motion Technology, Inc,
	6 Huron Drive
REV 001 6/99	Natick, MA01760



MTI-40 3 Phase NEMA 15-50 Plug Configuration

Motion Technology, Inc, 6 Huron Drive Natick, MA 01760

REV 001 6/99







Motion Technology, Inc. 6 Huron Drive, Natick MA, 01760

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OLD STYLE