# "MINI" STRIP HEATER SYSTEM





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### **Description:**

The "Mini" Strip Heater System is a fully integrated system for the preheating of alloy steels.

The system, is designed with safety as its primary criteria so that conformity to OSHA is maintained or exceeded. The controller is in a weather tight enclosure and all connections are water tight. Each power streamer is protected by three glow indicating fuses.

The system is designed for use at 480 volts, 3-phase, 60 HZ. The system can deliver up to 48 kw for preheat. It has a maximum capability of (24) 36", 2 kw heaters, for 72 linear feet of strip heaters. Under normal conditions, it can heat and maintain 36" of steel 2" thick to 300°F. The system has a maximum preheat temperature of 600°F.

"Mini" Strip Heater is an integral safe system and includes the controller, all secondary distribution and heaters. All the user needs to supply is an input cable to the controller. It can be connected to any 60 ampere (or larger) 480 volt, 3-phase outlet. The cables are sized to take maximum advantage of their current carrying capabilities and still maintain safety and reliability. All components are as light weight as possible and can easily be handled by 2 workers maximum. Water tight integrity is maintained from the output of the controller through to the heaters themselves.

### **Controller:**

Duraline Part No. 146 Input 480 volts, 3-phase, 60 hertz, 60 amperes.

The controller has a weather tight enclosure with a 60amp, 600-volt, 3-pole contactor unit. The contactor supplies power to (4) 20 ampere, 4 pole receptacles. Each receptacle has a weather cap and (3) neon glow indicating fuses (1 per phase), for overload protection. The controller has a step-down (480/120) transformer for the control circuits. Temperature control is by means of a 1-minute percentage timer (0 to 100%). The contractor will stay closed for that percentage of a minute for which the timer is set. (Example: with the timer set at 25%, the contactor is closed for 15 seconds and open for 45 seconds).

There is an Off/On switch and two pilot lights for power on and heaters on. All the controls are located on one side of the cabinet so that supervisory personnel at a glance can ascertain the following:

- 1. Power on
- 2. Heater Energized
- 3. Any fuses blown in the system

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## LAYOUT OF CONTACTOR - CONTROLLER



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### **Power Streamer:**

Duraline Part No. 147

The power streamer is an all molded distribution line, 62 - ½ feet in length. The main cable is #12/4 conductor type SOOW, 600-volt portable cord. The input plug is molded directly to the cable. There is a 47 - ½ foot leader followed by 6 molded taps on 3-foot centers. Each tap has 6 feet of #14/3 SOOW 105°C, 600-volt portable cord and is terminated in an integrally molded 3 pole female plug. The taps are connected to the main cable on a staggered phase arrangement so that a balanced 3 - phase load is maintained.

### **Strip Heaters:**

Duraline Part No. 36AF4-2000M

The standard strip heater used with the "mini" system is a 36" 2000-watt heater, imbedded into an efficient aluminum conductive shoe and reflective cover. A special attachment is used so that a male plug is attached directly to the heater assembly.

While the system is designed for 36" heaters, it may also be used to power 12", 18", and 24" heaters.

### **Strip Heaters Part Number:**

12460500-131B-14B10
12460650-131B-14B10
184601000-131B-14B10
244601000-131B-14B10
244601500-131B-14B10
364602000-1318-14810
364602500-1318-14810

12" 500W WITH 15MP3 Male Plug NON Thermostatic 12" 650W WITH 15MP3 Male Plug NON Thermostatic 18" 1000W WITH 15MP3 Male Plug NON Thermostatic 24" 1000W WITH 15MP3 Male Plug NON Thermostatic 24" 1500W WITH 15MP3 Male Plug NON Thermostatic 36" 2000W WITH 15MP3 Male Plug NON Thermostatic 36" 2500W WITH 15MP3 Male Plug NON Thermostatic

## LAYOUT OF STRIP HEATER ASSEMBLY



<u>REF#</u>	<u>QTY.</u>	DESCRIPTION
14	1	3-POLE MALE PLUG
15	1	STRAIN RELIEF ASSEMBLY
16	1	STRIP HEATER

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### Installation of the "Mini" System:

Duraline heaters are resistance elements which depend upon firm contact to the part for heat transfer. The cleaner the surface, the better the heat transfer. Therefore, rust, mill scale, paint, grease, etc., when possible, should be removed.

### Mounting of Heater:

Stud welding is the most widely used method of attaching heaters. A Capacitor Discharge stud welding unit is best suited for this application. This unit will give enough strength to secure your heater, with very shallow penetration, so that the studs may be easily removed after the heating cycle is complete.

Strapping, banding, and clamping may also be used, but care should be taken to ensure a good strong contact between the surfaces of the heater and the work piece.

On flat surfaces, the heater may be held down by a suitable weight. The pre-heater with aluminum shoe may be just laid on a flat surface for low temperature heating.

Regardless of which method is used, the heater must be mounted 2-3" away from the weld zone.

### **Stud Mounting:**

The heater cover is manufactured with elongated mounting holes at regular intervals. One stud or nail should be used per hole. On flat surfaces the heater should be "snugged down". After the system has been energized for about 15, minutes, all the units should be re-checked for tightness.

On curved or irregular surfaces, connect the heater on the junction box end first, then, bend the heater and shoe to the desired shape. Tighten the remaining studs. After the system has been energized for about 30 minutes, tap the cover with a leather or rubber mallet to insure good contact with the surface and re-tighten all the studs.

### Note:

If the heater and shoe cannot be bent to fit the surface when cold, energize the heater for a few minutes; it should then bend easily.

### **Banding or Strapping:**

Steel bands or straps such as those used for crates may be used to hold the pre-heaters in place (1/2") or wider). The band should cover the mounting holes that are in the cover assembly. One band should be used per hole so that all the mounting holes are covered.

The band should be as tight as possible to ensure good contact between the heater and the work. After the system has been energized for 15 to 20 minutes, the bands should be checked for tightness. If the bands have loosened, a suitable wedge can be used to tighten them.

### "C" Type Clamps:

When using pre-heaters close to an edge, "C" clamps may be used to secure them in place. A clamp should be placed directly over each mounting hole. The clamp should hold the heater tightly against the surface to be heated. After the system has been energized for 15 or 20 minutes, the clamps should be checked for tightness.

### **Connecting Power Streamer to Heaters:**

After the heaters have been mounted, they should be plugged into the power streamer. Care should be taken to ensure that the plugs are fully engaged and that there is no separation between the plug and the receptacle. Once the heaters have been plugged in, the streamer cablesshould be laid out as far from the heaters as possible.

### **Controller:**

The controller is the heart of the Duraline "Mini" system. It controls the heat input into the work by turning the system on and off. The timer is set on a desired percentage of a minute.

For example, a 10% setting would mean that the system would be on for 6 seconds and off for 54 seconds.

There is a pilot light that indicates power is available and a second light which indicates the heaters are energized.

### Approximate Timer Setting:

The timer setting will depend on many things, such as:

- 1. Temperature desired
- 2. Thickness of the metal
- 3. Heat losses due to wind, drafts, etc.

As a rule of thumb, the system should be started at 50% for pre-heating. Appropriate adjustments will have to be made to reach and maintain the desired temperature. Therefore, until the system has stabilized, it is necessary to check the work every 10 minutes or so.

### Use of the Controller:

The "Mini" controller can be used to control up to 4 power streamers simultaneously. Once the streamers are plugged in, the following procedure should be followed:

- 1. Turn on main disconnect to controller.
- 2. Set percentage timer to 50%
- 3. Turn controller on. You should get a power on indicating light immediately. Within 30 seconds maximum you should have a heater on light.
- 4. After 10 minutes check temperature of weldment. If rate of heating is too slow, raise timer.
- 5. Check weldment temperature periodically. When desired temperature is reached, reduce timer to ½ its setting.
- 6. Check weldment about 5 minutes later. If temperature is still rising, decrease timer. If temperature is falling, increase timer setting.

### Replacing Fuses in the Indicator Light/Fuse Container Assembly

1. Disconnect Power from Unit.

2. Using your thumb, press the indicating lamp lens in and twist to the left. Lamp and Fuse Holder will pop out of panel.

3. Pry the fuse out of the fuse clips.

4. Replace the old fuse with a new ATQ-30 fuse (Duraline P/N 007800) by pushing fuse into spring clips. **USE ONLY ATQ-30 FUSES!** 

- 5. Insert Indicator Light/Fuse Container into Panel socket with fuse facing up.
- 6. Push unit into socket and rotate to the right when it bottoms out. It will lock in place.
- 7. Reconnect power to the Controller.

### **General Precautions:**

- 1. Be sure the system is connected to 480V, 3–phase supply of 60 amperes minimum capacity.
- 2. Have work as clean as possible.
- 3. Secure heaters tight to the work.
- 4. Shield work against wind, breezes, drafts, etc.
- 5. Set the percentage timer.

### **Special Cautions:**

- A. The system has an excellent integral ground that is continuous from the #146 Control Panel to the strip heaters. Care must be taken that the #146 Panel has an external lug, which must have cable attached to it and running to a grounding rod or other appropriate means of good grounding practices. Care must be taken that the welding return offers a better path, otherwise the welding current will use the heater grounding system. This will result in a failure in the controller wiring. All welding grounds should be clean and tightly secured to the work. The welding cable and any connectors used (lugs or other type) should be in good, clean condition.
- B. PRIMARY VOLTAGE SHOULD NEVER EXCEED 480 VOLTS AT +5%
- C. When replacing fuse, only <u>Ferraz-Shawmut ATQ30 (30A, 500V)</u> must be used.
- D. Care must be taken to ensure the heater plugs are fully seated in the receptacles.

## **Trouble Shooting Chart**

Because of its simple design and rugged construction, the Mini System will provide many hours of trouble free operation. If a problem does occur, it will be easy to locate and remedy. The following are problems which could arise.

### Problem:

A. No power out of controller

### Action:

- 1a. Check main breaker or main fuse disconnect.
- 2a. Check off/on switch on controller.
- 3a. Check input power leads.
- 4a. Check controller transformer for 120 volts output.
- B. No power to heaters but power light on and heater light off.
- C. No power to heaters but power light on and heater light on
- D. 2/3 of the heaters in the system not heating.

E. All heaters on a power streamer not heating.

- 1b. Check that percentage timer is past the zero setting.
- 2b. Check for faulty percentage timer.
- 1c. Check contactor holding coil.
- 2c. Check contactor.
- 1d. Check main disconnect for blown fuse.
- 2d. Check input power cable for open in one phase.
- 3d. Check contactor for failure of one pole.
- 1e. Check that streamer plug is fully inserted into receptacle.
- 2e. Check streamer for open plug.
- 3e. Check receptacle.

## **Trouble Shooting Chart**

### Problem:

- F. 2/3 of the heaters on a streamer not heating.
- G. Isolated heater not heating.

H. Heaters are warm, but work will not come up to temperature.

- I. Heater failing at random.
- J. Fuse holders blowing out of containers.
- K. Heater plugs getting hot.

### Action:

- 1f. Check for blown fuse at the receptacle.
- 2f. Check power streamer for open lead.
- 3f. Check receptacle.
- 1g. Check assembly for open. If open:
  - a. Remove heater cover and check heater for continuity; if not open.
  - b. Check plug for open.
  - c. Check streamer tap for open.
- 1h. Check percentage timer. Increase if possible.
- 2h. Check heater contact with the work.
- 3h. Check for wind, breeze, or drafts across work. If present, screen off work area.
- 4h. Check primary voltage for low voltage condition.
- 1i. Check primary voltage. Should not exceed 480 volts + 5%.
- 2i. Heater too close to welding.
- 1j. Wrong replacement fuses being used. Replacement fuses must be <u>Ferraz-Shawmut ATQ30 (30A, 500V)</u>
- 1k. Check seating of male plug in power streamer receptacle.

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## Parts List:

<u>REF #</u>	ITEM	MANUFACTURER	<u>CATALOG NO.</u>	RATING
1A & 1B	Contactor	Allen Bradley	702L-COD93 SERIES K	
2A	Fuse Holder	Bussman	HGC	
2B	Fuse	Ferraz-Shawmut	ATQ30	30 amp
3A	Receptacle	Duraline	074	18 amp
3B	Receptacle Cover	Duraline	071	
4	Transformer	Sola Basic Ind.	W-75 SERIES A Type SBW	.075 KVA
5A	On-Off Switch	Hubbell	1221	20 amp single pole
5B	Dead Front Activator	Killark	FST	
6 & 7	Power On Indicating Light	Drake	5799-556 (specify color)	
8	Percentage Timer	American Timer Co.	Туре 0304С- 007А- 00ВН	
9	4 Pole Male Plug	Duraline	072	18 amp
10	SOOW Cable			
11	Power Tap	Duraline	095	
12	SOOW, 105°C			
13	3 Pole Female Plug	Duraline	132	
	Power Streamer	Duraline	147	18 amp
14	3 Pole Male Plug	Duraline	131	15 amp
15	Strain Relief Assembly	Duraline	139	
	Male Heater Input Assy.	Duraline	131-014-139-001	15 amp
16	36" Strip Heater	Duraline	36AF4-2000	2000 watts
	24" Strip Heater	Duraline	24AF4-1500	1500 watts
	18" Strip Heater	Duraline	18AF4-1000	1000 watts
	12" Strip Heater	Duraline	12AF4-500	500 watts

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## DETAILS OF POWER STREAMER



SCHEMATIC FOR POWER STREAMER



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Improperly Mated (Note: Gap between faces of plugs)



Properly Mated (Note: Faces of plugs butt against each other)



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### **Recommended Spare Parts List:**

### **Replacement Parts for Strip Heater Unit:**

Part #	Description
NPN-72	Aluminum Cover for 72" Strip Heater
NPN-36	Aluminum Cover for 36" Strip Heater
NPN-24	Aluminum Cover for 24" Strip Heater
NPN-18	Aluminum Cover for 18" Strip Heater
NPN-12	Aluminum Cover for 12" Strip Heater
AS4-72	Aluminum Shoe for 72" Strip Heater
AS4-36	Aluminum Shoe for 35" Strip Heater
AS4-24	Aluminum Shoe for 24" Strip Heater
AS4-18	Aluminum Shoe for 18" Strip Heater
AS4-12	Aluminum Shoe for 12" Strip Heater
#139	Heater Strain Relief Nut

### Replacement Parts for #146 Controller:

Part #	Description
702L-COD93	Allen Bradley Contractor, Series K
EGC	Bussman Fuse Holder
ATQ30	Ferraz-Shawmut, 30A,500V
1221	ON-OFF Switch, Hubbell, 20 Ampere, Single Pole
5799-523	Drake, Red, Power On Indicating Light
5799-523	Drake, Green, Power On Indicating Light
0304C-007A-00BH	American Timer Company Percentage Timer

Replacement parts for the #146 Controller should be purchased from your local electrical supply out.

### **Replacement Parts for Electrical Distribution**

Part #	Description
179	Receptacle for #146 Control Panel
147	Complete Power Streamer
132-014-000-006	Power Streamer Tap, 15FP3 on 6' of 14/3 SOOW, 105°C
131-014-000-002	Heater Cord, 15MP3 on 2' of 14/3 SOOW, 105°C
210-014-000-012	Bridle, 3-Way, Heater Extension with 15MNFP-3 on
	14/3 SOOW, 105°C

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