

MODEL EHR-85 FIBER DRAWING FURNACE

The Model EHR-85 fiber drawing furnace is designed for operation to 2400°C with preforms up to 41 mm in diameter. The furnace features a simplified long-life, high-purity graphite resistance element which delivers concentrated heat through a linear graphite tube (available with a split liner for altering the hot zone profile) that serves to protect the element and control inert gas flow. Encapsulated graphite felt insulation surrounds the heating element. Protective inert gas flow routing is simple and effective with top and bottom gas screens, top adjustable iris assembly and bottom water-cooled slide door assembly. Safety interlocked top and bottom plugs permit convenient evacuation and backfilling of the furnace prior to operation. A 30 kVA power supply is also included, complete with a separately housed main transformer in a NEMA enclosure and 10 feet of flexible power cables to couple the furnace to the transformer.

The Model EHR-85 drawing furnace coupled with Thermal Technology Inc.'s Gas Purification and Oxygen Analyzer will produce excellent element life in excess of 1000 hours.

OPERATING GAS

The furnace ***MUST*** be operated with an inert gas (helium, argon, or an argon/helium mixture). The gas must be dry and oxygen-free (less than 1 PPM water and oxygen). The use of Thermal Technology Inc.'s Gas Purification System (Model IGP-1B) is recommended.

RECOMMENDED ACCESSORIES

- Vacuum Pump
- Gas Purification and Oxygen Analyzer
- Optical Pyrometer
- Temperature Controller

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SPECIFICATIONS

Group 1500

High Temperature

Glass Fiber Drawing Furnace

Model EHR-85

Overall Clearance Size

18" (450 mm) diameter is required to clear all furnace parts, extensions, water lines and gas fittings.

Mounting

The bottom of the furnace is fitted with four mounting posts, 0.56" hexagonal, for mounting to the tower plate. The posts are threaded 1/4"-20 x 1/2" deep on a 10.50" (266.7 mm) bolt circle. The mounting threads are equally spaced at 90°, beginning 45° from the front of the furnace.

The tower plate must have a minimum 6" diameter (150 mm) hole through it on the mounting centerline to provide access to the furnace bottom door and gas screen assembly. It is preferable to have a minimum 5" (127 mm) wide slot out the rear of the tower plate to clear water and gas lines or mount the furnace an additional 1" (25 mm) above the tower plate.

Height

When mounted, the distance from the top surface of the tower plate to the centerline of the draw hot zone is 3.9" (99 mm). The distance from the top surface of the tower plate to clear all top furnace fittings, power connections and insulation covers is 12" (305 mm).

Top Access

The top insulation cover and connections allow a 5.5" (140 mm) diameter, centered, clear access to the entry top port into the furnace. This clear access is to within 4.95" (126 mm) of the centerline of the draw hot zone. The standard gas screen/diaphragm assemble adds 1.56" (40 mm).

Bottom Access

The exit bottom port into the furnace is 3.35" (85 mm) from the centerline of the draw hot zone. The standard gas screen adds 1.56" (40 mm).

Rear Access

Flexible power cables connect to electrodes at the top of the furnace. A 14" (355 mm) wide

clear access out the rear of the tower is required to route the two cables from the furnace to the power supply.

Entry and Exit Ports

Top and bottom ports are closed with an easily replaced top (threaded) iris diaphragm assembly and bottom slide door assembly allowing a maximum entry/exit opening of 1.61" (41 mm). The top iris and bottom slide door assembly closes to a minimum 0.25" (6 mm) diameter for internal gas flow control, and for closure while changing preform rods with the furnace at maximum temperature.

Radial Ports

Two 1 1/8"-16 threaded ports are provided to view the center of the furnace hot zone. Both ports view the heating element through a 0.31" (8 mm) diameter sighting hole. One port is located 45° to the right of the front of the furnace, the other 90° to the left (135° apart).

Gas Ports

Ports with compression fittings for 1/4" or 6 mm outside diameter tubing are provided for gas inlets and venting. All fittings extend toward the rear of the furnace and serve the following purposes:

- Top gas curtain, inlet.
- Bottom gas curtain, inlet.
- Radial purge, inlet. This port admits inert gas into the thermal insulation area for purge prior to beginning furnace heat-up.
- Radial pressure monitor. This port allows connection of a vacuum pump.

Interior Access

All furnace maintenance can be accomplished without removing the furnace from the drawing tower, disconnecting any water-cooling lines, or removing any radial windows or control instrumentation.

The single-piece liner is replaced by removing the top iris and gas screen assembly. The two-piece graphite liner top section is similarly replaced by removing the top iris/gas screen assembly. For removal of the bottom and/or bottom and top graphite liner the bottom slide door assembly and gas screen is removed. The heating element is replaced by additionally removing a top plate cover. The heating element is secured at the top to power electrodes using two taper clamps having four mounting screws each. By removing the top furnace head, the entire thermal insulation assembly can be lifted from the furnace as a one-piece assembly. Power cables can remain connected for all operations described.

Interior Components

The furnace interior is free of ceramics and other possibly contaminating materials. All components are solid, ultra-purified graphite having a typical ash content less than 20 PPM.

The furnace assembly is completely sealed with viton O-rings. End caps are provided to allow vacuum purging prior to operation. These solid caps are inserted through top iris and bottom door for vacuum operation.

Power Supply

The furnace power supply and controls are enclosed in separate cabinets. A base mounting enclosure, 24" wide x 28" deep x 45" high (610 mm x 730 mm x 1140 mm), contains the

main power transformer and can be positioned on or near the drawing tower. Top exiting flexible power cables, 10' (3 m) long, connect the furnace to the power transformer (longer cables optionally available). This enclosure also contains the following components:

- SCR (thyristor) power regulator, 240V, 150A, 1 phase, 0-5V input.
- Furnace power contactor, 240V, 150A, 2 pole.
- Control power step-down transformer, 1 KVA, 240V/120V.
- System fusing.
- Water distribution manifold and flow switches.

Facility sources of operation power and cooling water are connected into this enclosure.

Furnace controls are enclosed in a separate bench mounting cabinet which is provided with standard 19" notched rack mounting extensions. Cabinet size is 17" wide x 14" deep x 10.5" high (430 mm x 355 mm x 267 mm).

The control cabinet contains the following:

- Control power on-off switch.
- Furnace power on-off buttons.
- Operate/reset switch.
- Indicator lamps.
- Water flow warning lamp and alarm.
- Manual control and limit 10-turn potentiometer.
- Furnace power (transformer secondary) ammeter and voltmeter.
- Optional automatic temperature controller.

The power supply is capable of providing furnace power of 50 volts and 600 amperes. Furnace power required is nominally 14 KVA, depending upon operating temperatures. The power supply range provided allows beginning operation at the higher currents and having voltage reserve available for operating as the heating element ages and its resistance increases. This allows continuous operation without the requirement to shut the system down to change transformer voltage taps.

Power is manually adjustable from 0-100% by means of the panel-mounted, 10-turn potentiometer. A safety interlock with warning lamp, audible alarm, and operate/reset switch monitors cooling water flow and will shut the system off in case of insufficient flow for furnace cooling.

Control cabinet and power supply enclosure are connected with 16' (5 m) of cable.

Power Supply Options

Automatic Temperature Controller:

The standard temperature control instrument provides a proportional, isolated, 0-5 volt d.c. analog output and has a digital setpoint for accurate and convenient programming. The 3-mode instrument has adjustable, proportional band, reset, and rate to permit matching the controller to the thermal response characteristics of the furnace. Other features include upscale thermocouple break protection and output stage power feed-back to compensate for varying line voltage changes.

Temperature Sensor:

The normal control sensor for use with the EHR-85 and automatic temperature controller is the radiation pyrometer option. Included is a viewing window for the front furnace radial port and a mounting adapter designed to match the optical geometry of the furnace sighting tube.

Facility Requirements

- Electric:** The power supply is completely wired for operation from one source of single phase, 150 ampere power. Facility voltage required is 208/230 volts, 60 Hz or 220 volts , 50 Hz. Options for operation from 440/480 or 380 volts, single or three phase power are available at additional cost.
- Water:** Furnace cooling water is required at a minimum continuous rate of 4.0 gpm at 55 psid, 65-85° F (14 liters/minute at 380 Kpa, 18-30° C). The water should be filtered if it contains sand or other solid matter.
- Operating Gas:** The furnace must be operated with an inert gas - argon, helium or argon/helium mixture. The gas must be dry and oxygen free, less than 1 PPM H₂O and O₂. Use of Thermal Technology's gas purification furnace is recommended.
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MODEL HR-80 FIBER DRAWING FURNACE

The Model HR-80 fiber drawing furnace is designed for operation to 2400°C with preforms up to 30 mm in diameter. The furnace features a simplified long-life, high-purity graphite resistance element which delivers concentrated heat through a linear graphite tube (available with a split liner for altering the hot zone profile) that serves to protect the element and control inert gas flow. Encapsulated graphite felt insulation surrounds the heating element. Protective inert gas flow routing is simple and effective with top and bottom gas screens, top adjustable iris assembly and bottom water-cooled slide door assembly. Safety interlocked top and bottom plugs permit convenient evacuation and backfilling of the furnace prior to operation. A 20 or 30 kVA power supply is also included, complete with a separately housed main transformer in a NEMA enclosure and 10 feet of flexible power cables to couple the furnace to the transformer.

The Model HR-80 drawing furnace coupled with Thermal Technology Inc.'s Gas Purification and Oxygen Analyzer will produce excellent element life in excess of 1000 hours.

OPERATING GAS

The furnace *MUST* be operated with an inert gas (helium, argon, or an argon/helium mixture). The gas must be dry and oxygen-free (less than 1 PPM water and oxygen). The use of Thermal Technology Inc.'s Gas Purification System (Model IGP-1B) is recommended.

RECOMMENDED ACCESSORIES

- Vacuum Pump
- Gas Purification and Oxygen Analyzer
- Optical Pyrometer
- Temperature Controller

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SPECIFICATIONS

Group 1500

High Temperature

Glass Fiber Drawing Furnace

Model HR-80

Overall Clearance Size

18" (450 mm) diameter is required to clear all furnace parts, extensions, water lines and gas fittings.

Mounting

The bottom of the furnace is fitted with four mounting posts, 0.56" hexagonal, for mounting to the tower plate. The posts are threaded 1/4"-20 x 1/2" deep on a 10.50" (266.7 mm) bolt circle. The mounting threads are equally spaced at 90°, beginning 45° from the front of the furnace.

The tower plate must have a minimum 6" diameter (150 mm) hole through it on the mounting center line to provide access to the furnace bottom door and gas screen assembly. It is preferable to have a minimum 5" (127 mm) wide slot out the rear of the tower plate to clear water and gas lines; or mount furnace an additional 1" (25 mm) above the tower plate.

Height

When mounted, the distance from the top surface of the tower plate to the centerline of the draw hot zone is 3.4" (86 mm). The distance from the top surface of the tower plate to clear all top furnace fittings, power connections and insulation covers is 11" (279 mm).

Top Access

The top insulation cover and connections allow a 5.5" (140 mm) diameter, centered, clear access to the entry top port into the furnace. This clear access is within 4.95" (126 mm) of the centerline of the draw hot zone. The standard gas screen/ diaphragm assembly adds 1.56" (40 mm).

Interior Components

The furnace interior is free of ceramics and other possibly contaminating materials. All components are solid, ultra-purified graphite having a typical ash content less than 20 ppm.

The furnace assembly is completely sealed with Viton O-rings. Optional end caps are available to allow vacuum purging prior to operation. These solid caps replace the top and bottom iris diaphragms for vacuum operation.

Power Supply

The furnace power supply and controls are enclosed in separate cabinets. A base mounting NEMA 1 enclosure 20" wide x 25" deep x 36" high (510 mm x 630 mm x 915 mm) contains the main power transformer, and can be positioned on or near the drawing tower. Top exiting flexible power cables 10' (3 m) long connect the furnace to the power transformer (longer cables optionally available). This enclosure also contains the following components:

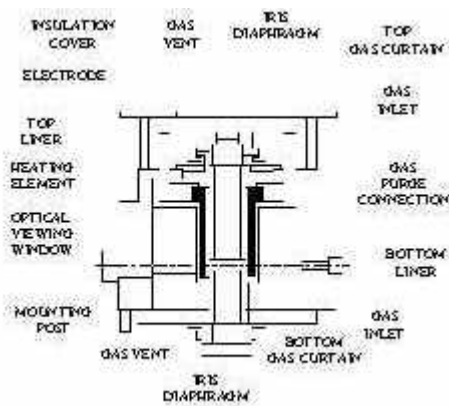
- SCR (thyristor) power regulator
- Furnace power contactor
- Control power step-down transformer
- System fusing

Facility sources of operation power and cooling water are connected into this enclosure.

Furnace controls are enclosed in a separate bench mounting cabinet which is provided with standard 19" notched rack mounting extensions. Cabinet size is 17" wide x 14" deep x 10.5" high (430 mm x 355 mm x 267 mm).

The control cabinet contains:

- Control power on-off switch
- Furnace power on-off buttons
- Operate/reset switch
- Auto/manual switch
- Sensor/transducer switch
- Indicator lamps
- Water flow warning lamp and alarm



- Manual control and limit 10-turn potentiometer
- Furnace power (transformer secondary) ammeter and voltmeter
- Optional automatic temperature controller
- Optional power transducer control

The power supply is capable of providing furnace power of 40 volts and 500 amperes. Furnace power required is nominally 12 kVA, depending upon operating temperatures. The power supply range provided allows beginning operation at the higher currents and having voltage reserve available for operating as the heating element ages and its resistance increases. This allows continuous operation without the requirement to shut the system down to change transformer voltage taps.

Power is manually adjustable from 0-100% by means of the panel-mounted 10-turn potentiometer. A safety interlock with warning lamp, audible alarm, and operate/reset switch monitors cooling water flow and will shut the system off in case of insufficient flow for furnace cooling. Control cabinet and power supply enclosure are connected with 16' (5 m) of cable.

Power Supply Options

Automatic Temperature Controller. The standard temperature control instrument provides a proportional isolated 0-5 volt d.c. analog output and has a digital set point using accurate and convenient thumb-wheel switches. The 3-mode instrument has adjustable, proportional band, reset, and rate to permit matching the controller to the thermal response characteristics of the furnace. Other features include a deviation indicator, upscale thermocouple break protection, circuitry to inhibit overshoot and start-up, or on set- point change, and output stage power feedback to compensate for varying line voltage changes.

Temperature Sensor. The normal control sensor for use with the HR-80 and automatic temperature controller is the radiation pyrometer option. Included is a millivolt amplifier assembled into the power control cabinet, viewing window for the front furnace radial port, and a mounting adaptor designed to match the optical geometry of the furnace sighting tube.

Power Transducer. Automatic power control is available. A power transducer is substituted for the temperature sensor and used in conjunction with the automatic temperature control instrument and can be used over the full range of the power supply.

Bottom Access

The exit bottom port into the furnace is 2.85" (72 mm) from the centerline of the draw hot zone. The standard gas screen/diaphragm adds 1.56" (40 mm). With the furnace mounted on the tower plate using the posts provided, the distance down from the tower plate top surface to clear the exit gas screen/diaphragm assembly is 1.01" (26 mm).

Rear Access

Flexible power cables connect to electrodes at the top of the furnace. A 14" (355 mm) wide clear access out the rear of the tower is required to route the two cables from the furnace to the power supply.

Entry and Exit Ports

Top and bottom ports are closed with an easily replaced (threaded) iris diaphragm assembly allowing a maximum entry/exit opening of 1.18" (30 mm). The iris closes to a minimum 0.04" (1 mm) diameter for internal gas flow control, and for closure while changing preform rods with the furnace at maximum temperature. Optional gas screen/diaphragm assemblies are available with openings to 1.65" (42 mm).

Radial Ports

Two 1 1/8"-16 threaded ports are provided to view the center of the furnace hot zone. Both ports view the heating element through a 0.31" (8 mm) diameter sighting hole. One port is located 45° to the right of the front of the furnace, the other 90° to the left (135° apart).

A window is installed in the left port which views through the heating element. The right port views the exterior of the element for accurate temperature control using an optional radiation pyrometer. This port is plugged but will accept the standard window assembly.

Gas Ports

Ports with compression fittings for 1/4" or 6 mm outside diameter tubing are provided for gas inlets and venting. All fittings extend toward the rear of the furnace and serve the following purposes:

- Top gas curtain, inlet, with quick disconnect.
- Bottom gas curtain, inlet, with quick disconnect.
- Radial purge, inlet. This port admits inert gas into the thermal insulation area for purge prior to beginning furnace heat-up.
- Radial pressure monitor. This port allows connection of a very low pressure gauge (1 inch water) to monitor interior pressure with respect to the exterior.

Vents

Gas inlets at top and bottom gas curtains flow to the center of the draw hot zone, exit this area radially, and flow outside the liner tubes to exit at

Interior Access

All furnace maintenance can be accomplished without removing the furnace from the drawing tower, disconnecting any water-cooling lines or removing any radial windows or control instrumentation.

The bottom graphite liner is replaced by removing the furnace bottom door/gas screen assembly. The top graphite liner is similarly replaced by removing the top door/gas screen assembly. The heating element is replaced by additionally removing a top cover plate. The heating element is secured at the top to power electrodes using two taper clamps having four mounting screws each. By removing the top furnace head, the entire thermal insulation assembly can be lifted from the furnace as a one piece assembly. Power cables can remain connected for all operations described.

Floor Mounting Cabinet. An upright 19-inch wide rack cabinet with base is available for mounting the power control cabinet. This is required when accessories other than the automatic temperature controller are ordered. The 24" wide x 26" deep x 72" high (600 mm x 650 mm x 1830 mm) enclosure will accommodate recording, programming and other optional accessories.

Facility Requirements

Electric: The power supply is completely wired for operation from one source of single phase, 100 ampere power. Facility voltage required is 208/230 volt, 60 Hz; or 220 volt, 50 Hz.

Options for operation from 440/480 or 380 volt, single or 3 phase power are available at added cost.

Water: Furnace cooling water is required at a minimum continuous rate of 2.5 gpm at 55 psid, 65-85°F (9.5 l/min. at 380 Kpa, 18-30°C). The water should be filtered if it contains sand or other solid matter.

Operating Gas: The furnace must be operated with an inert gas, nitrogen or argon/ helium. Optional zirconia muffle tube assemblies can be supplied for drawing in an oxidizing atmosphere.

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MODEL HR-81 FIBER DRAWING FURNACE

The Model HR-81 fiber drawing furnace is designed for operation to 2400°C with preforms up to 61 mm in diameter. The furnace features a simplified long-life, high-purity graphite resistance element which delivers concentrated heat through a linear graphite tube (available with a split liner for altering the hot zone profile) that serves to protect the element and control inert gas flow. Encapsulated graphite felt insulation surrounds the heating element. Protective inert gas flow routing is simple and effective with top and bottom gas screens, top adjustable iris assembly and bottom water-cooled slide door assembly. Safety interlocked top and bottom plugs permit convenient evacuation and backfilling of the furnace prior to operation. A 30 kVA power supply is also included, complete with a separately housed main transformer in a NEMA enclosure and 10 feet of flexible power cables to couple the furnace to the transformer.

The Model HR-81 drawing furnace coupled with Thermal Technology Inc.'s Gas Purification and Oxygen Analyzer will produce excellent element life in excess of 1000 hours.

OPERATING GAS

The furnace ***MUST*** be operated with an inert gas (helium, argon, or an argon/helium mixture). The gas must be dry and oxygen-free (less than 1 PPM water and oxygen). The use of Thermal Technology Inc.'s Gas Purification System (Model IGP-1B) is recommended.

RECOMMENDED ACCESSORIES

- Vacuum Pump
- Gas Purification and Oxygen Analyzer
- Optical Pyrometer
- Temperature Controller

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MODEL HR-81 FIBER DRAWING FURNACE

SPECIFICATIONS

Group 1500

Model HR-81 Fiber Drawing Furnace

Overall Clearance Size

18" (450 mm) diameter is required to clear all furnace parts, extensions, water lines and gas fittings.

Mounting

The bottom of the furnace is fitted with four mounting posts, 0.56" hexagonal, for mounting to the tower plate. The posts are threaded 1/4" -20 x 1/2" deep on a 11.1" (282 mm) bolt circle. The mounting threads are equally spaced at 90°, beginning 45° from the front of the furnace.

The tower plate must have a minimum 7" diameter (178 mm) hole through it on the mounting centerline, slotted out the front of the plate, to provide access to the furnace bottom door and gas screen assembly.

Height

When mounted, the distance from the top surface of the tower plate to the centerline of the draw hot zone is 6.5" (165 mm). The distance from the top surface of the tower plate to clear all top furnace fittings, power connections and insulation covers is 16" (406 mm).

Bottom Access

The exit bottom port into the furnace is 4.10" (104 mm) from the centerline of the draw hot zone. The standard gas screen adds 6.25" (158 mm). With the furnace mounted on the tower plate using the posts provided, the distance down from the tower plate top surface to clear the exit gas screen assembly is 4.25" (108 mm).

Rear Access

Flexible power cables connect to electrodes at the top of the furnace. A 14" (355 mm) wide clear access out the rear of the tower is required to route the two cables from the furnace to the power supply.

Entry and Exit Ports

The top port is closed with a single sliding water-cooled door when there is no preform in the furnace. In the open position the door provides an opening of 2.5" (63 mm). The bottom port is closed with dual sliding water-cooled doors with a minimum opening of 0.25" (6 mm). Replaceable threaded iris diaphragm assemblies are available as options for both the top and bottom ports. The irises have an adjustable range of 0.2" (5 mm) to 2.5" (63 mm).

Radial Ports

Two 1 1/8" -16 threaded ports are provided to view the center of the furnace hot zone. Both ports view the heating element through a 0.31" (8 mm) diameter sighting hole. One port is located 45° to the right of the front of the furnace, the other 90° to the left (135° apart).

A window is installed in the left port which views through the heating element. The right port views the exterior of the element for accurate temperature control using an optional radiation pyrometer. This port is plugged, but will accept the standard window assembly.

Gas Ports

Ports with compression fittings for 1/4" (6 mm) outside diameter tubing are provided for gas inlets and venting. All fittings extend toward the rear of the furnace and service the following purposes:

- Top gas curtain, inlet, with quick disconnect.
- Bottom gas curtain, inlet, with quick disconnect.
- Radial purge, inlet - this port admits inert gas into the thermal insulation area for purge prior to beginning furnace heat-up.
- Radial pressure monitor - this port allows connection of a very low pressure gauge (1" water) to monitor interior pressure with respect to the exterior.

Vents

Gas inlets at top and bottom gas curtains flow to the center of the draw hot zone, exit this area radially, and flow outside the liner tubes to exit at the bottom of the furnace. An additional vent port is provided at the top to allow optional gas flow pattern from the bottom and exiting at the top.

Interior Access

All furnace maintenance can be accomplished without removing the furnace from the drawing tower, disconnecting any water cooling lines or removing any radial windows or control instrumentation.

The bottom graphite liner is replaced by removing the furnace bottom door/gas screen assembly. The top graphite liner is similarly replaced by removing the top door/gas screen assembly. The heating element is replaced by additionally removing a top cover plate. The heating element is secured at the top to power electrodes using two taper clamps which have four mounting screws each. By removing the top furnace head, the entire thermal insulation assembly can be lifted from the furnace on a one-piece assembly. Power cables can remain connected for all operations described.

Interior Components

The furnace interior is free of ceramics and other possibly contaminating materials. All components are solid, ultra-purified graphite having a typical ash content less than 20 ppm.

The furnace assembly is completely sealed with viton O-rings. Optional end caps are available to allow vacuum purging prior to operation. These solid caps replace the top and bottom iris diaphragms for vacuum operation.

Power Supply

The furnace power supply and controls are enclosed in separate cabinets. A base mounting enclosure, 24" wide x 28" deep x 45" high (610 mm x 730 mm x 1140 mm), contains the main power transformer and can be positioned on or near the drawing tower. Top exiting flexible power cables, 10' (3 m) long, connect the furnace to the power transformer (longer cables optionally available). This enclosure also contains the following components:

- SCR (thyristor) power regulator, 240 V, 150 A, 1 phase, 0-5 V input.
- Furnace power contactor, 240 V, 150 Z, 2 pole.
- Control power step-down transformer, 1 KVA, 240 V/120 V.
- System fusing.
- Water distribution manifold and flow switches.

Facility sources of operation power and cooling water are connected into this enclosure.

Furnace controls are enclosed in a separate bench mounting cabinet which is provided with standard 19" notched rack mounting extensions. Cabinet size is 17" wide x 14" deep x 10.5" high (430 mm x 355 mm x 267 mm).

The control cabinet contains the following:

- Control power on-off switch.
- Furnace power on-off buttons.
- Operate/reset switch.
- Auto/manual switch.
- Sensor/transducer switch.
- Indicator lamps.
- Water flow warning lamp and alarm.
- Manual control and limit 10-turn potentiometer.
- Furnace power (transformer secondary) ammeter and voltmeter.
- Optional automatic temperature controller.
- Optional power transducer control.

The power supply is capable of providing furnace power of 50 volts and 600 amperes. Furnace power required is nominally 16 KVA, depending upon operating temperatures. The power supply range provided allows beginning operation at the higher currents and having voltage reserve available for operating as the heating element ages and its resistance increases. This allows continuous operation without the requirement to shut the system down to change transformer voltage taps.

Power is manually adjustable from 0-100% by means of the panel-mounted, 10-turn potentiometer. A safety interlock with warning lamp, audible alarm, and operate/reset switch monitors cooling water flow and will shut the system off in case of insufficient flow for furnace cooling.

Control cabinet and power supply enclosure are connected with 16' (5 m) of cable.

Power Supply Options

Automatic Temperature Controller:

The standard temperature control instrument provides a proportional, isolated, 0-5 volt dc analog output and has a digital setpoint using accurate and convenient thumbwheel switches. The 3-mode instrument has adjustable, proportional band, reset, and rate to permit matching the controller to the thermal response characteristics of the furnace. Other features include a deviation indicator, upscale thermocouple break setpoint change and output stage power feedback to compensate for varying line voltage changes.

Temperature Sensor:

The normal control sensor for use with the HR-81 and automatic temperature controller is the radiation pyrometer option. Included is a millivolt amplifier assembled into the power control cabinet, viewing window for the front furnace radial port, and a mounting adapter designed to match the optical geometry of the furnace sighting tube.

Facility Requirements

- Electric:** The power supply is completely wired for operation from one source of single phase, 150 ampere power. Facility voltage required is 208/230 volts, 60 Hz or 220 volts, 50 Hz. Options for operation from 440/480 or 380 volts, single or 3 phase power are available at additional cost.
- Water:** Furnace cooling water is required at a minimum continuous rate of 4.0 gpm at 55 psid, 65-85°F (14 liters/minute at 380 Kpa, 18-30°C). The water should be filtered if it contains sand or other solid matter.
- Operating Gas:** The furnace must be operated with an inert gas - nitrogen or argon/helium. The gas must be dry and oxygen-free, less than 1 ppm H₂O and O₂. Use of Astro's gettering furnace is recommended.

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