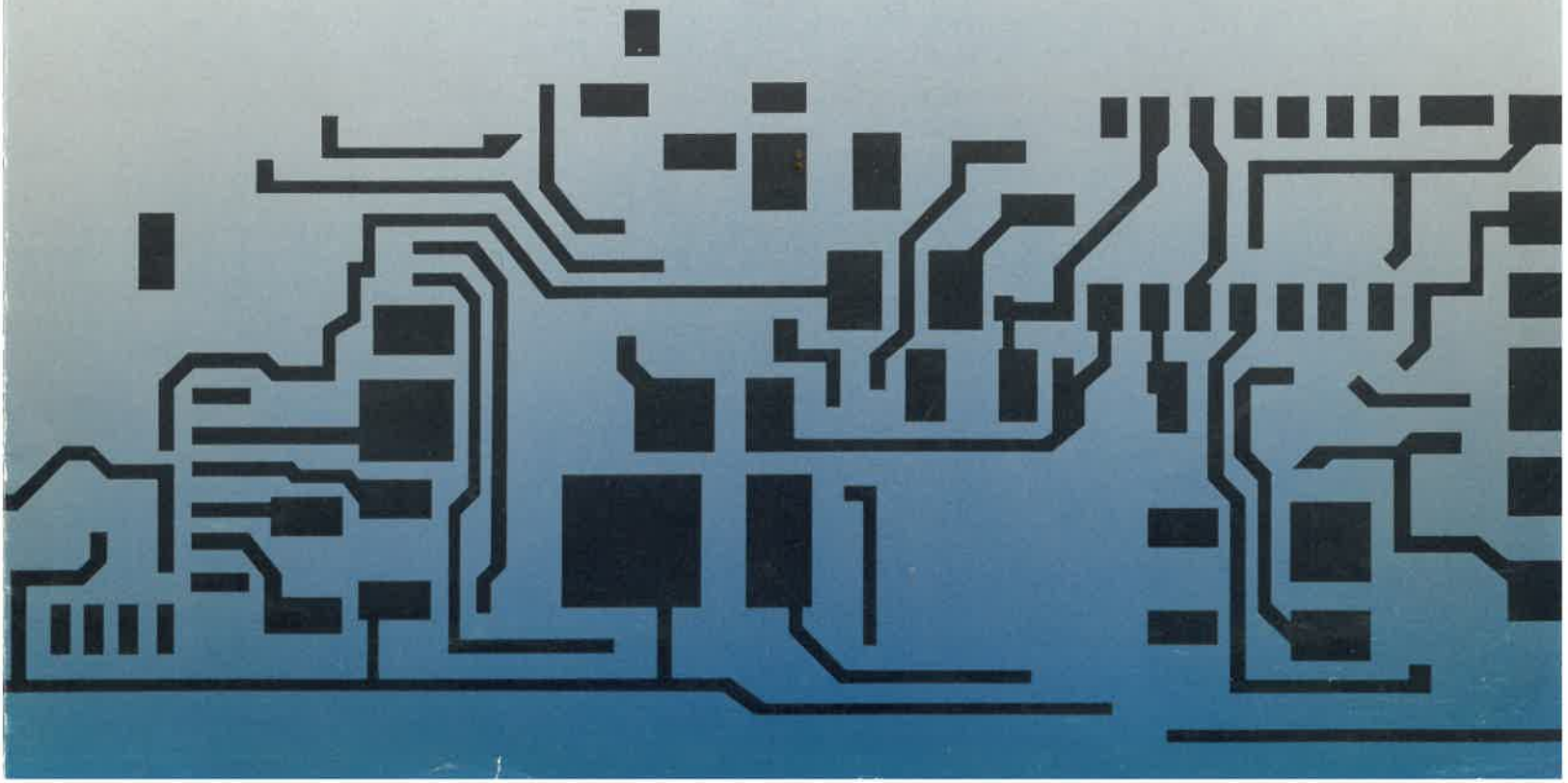
QUICK RESPONSE

Watkins-Johnson QR Series

THICK FILM FIRING FURNACE



QUICK RESPONSE

The QR Series is a production-oriented,

General Description

Watkins-Johnson *Quick Response* (QR) Series furnaces are designed for precise thermal processing of air fireable thick-film materials. A rugged and proven design ensures maximum reliability and service-ability. W-J's three decades of experience in manufacturing high-quality production equipment ensures all critical furnace parameters are designed to meet or exceed process requirements.

Temperature Control

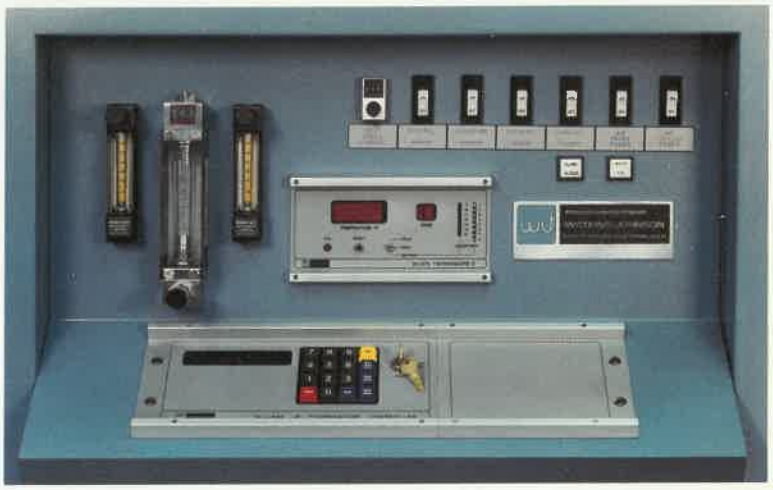
Temperature control is accomplished through the WJ-988 process controller. Precise control of independent heated zones is ensured by three-mode system tuning. Additional features are:

- Eight-recipe memory
- RS-232 Communication port
- Hi/Low process alarm
- Five-year battery backup
- Self-diagnostics and compat-ibility with our exclusive WJ-989 computer-based multi-furnace monitor and control system.

Power Control

Optically isolated solid-state relays are directed to apply power to the heating elements by the WJ-988 controller. Zero crossover current control is utilized to prevent spurious line signals.

Power availability is two to three times that of typical consumption to ensure responsiveness to changing load. Ramp-up from ambient to 850°C can be accomplished in less than 20 minutes.



▲ Furnace Control System

Heated Chamber

The heating chamber in the QR Series incorporates low-mass heating panels which provide *Quick Response* to profile changes. The chamber is designed to be extremely durable and efficient. Design features include:

Heating Elements

- Medium to long wave IR emitter
- High-emissivity coating on radiating surface
- Kanthal A-1 element wire vacuum molded into low-mass ceramic fiber panels
- Element life exceeds 10,000 hours of operation

Insulation Package

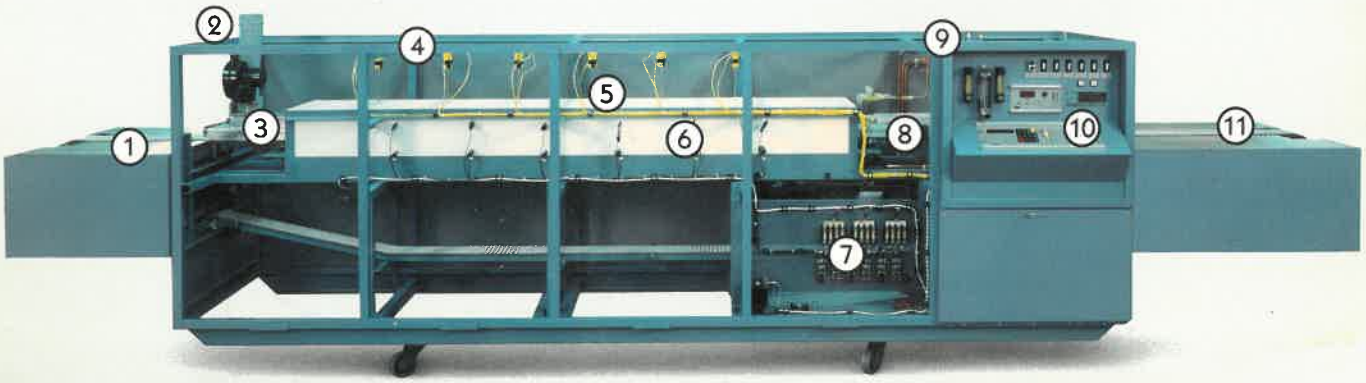
- Low thermal mass
- Three-tiered with each tier graded relative to thermal location
- Optimal thermal response and heat retention

Belt Support Hearth

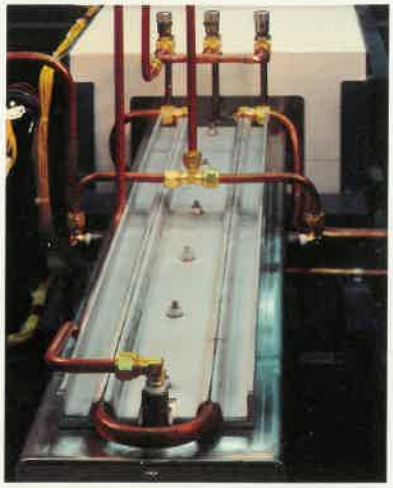
- Clear fused quartz rods
- Low coefficient of friction
- Transparent to IR

Furnace Detail

1. Load table
2. Exhaust outlet
3. Entry chamber
4. Furnace frame
5. Heating box and elements
6. Thermal insulation
7. Element power controls
8. Exit/cooling chamber
9. Utility connections
10. Control systems
11. Conveyor belt



cost-effective, conveyor furnace line, designed for thick-film firing.



▲ **Atmosphere Plumbing and Water Cooling System**

Atmosphere Control

Superior atmosphere control for the most demanding of applications is provided. Atmosphere inlet controls are provided for separate sections of the chamber and end curtain. A powered exhaust system provides efficient removal of burnout by-products ensuring high quality processing of parts. A trap in the exhaust system prevents any condensate of burnout products from being reintroduced into the furnace chamber. The atmosphere distribution system also provides a means of controlling cross-belt temperature gradients.

Heated Chamber ▶
(Internal view of Model 6QR-73)

Safety Systems

The Model WJ-979 Thermoguard Scanning Overtemperature Protection System shuts off all element power and initiates an audible and visual alarm in the event any zone exceeds a pre-set temperature. The overtemperature zone is indicated on the digital readout. Open thermocouple protection is provided. An open thermocouple in the control circuit will drive the controller upscale, thereby turning off the power to the affected zone. An open thermocouple in the overtemperature system will shut off element power and initiate audible and visual alarms.

Loss of flow in the cooling water system shuts off conveyor and element power and initiates audible and visual alarms.

An optional conveyor belt-stop alarm is available that will initiate both audible and visual alarms in the event of failure of the conveyor system.

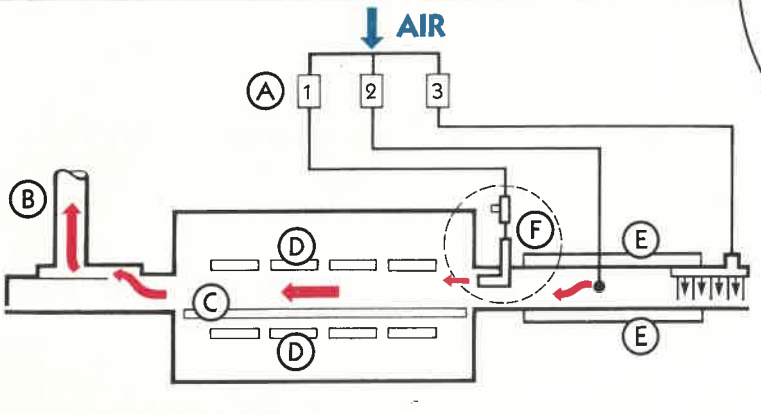
Installation

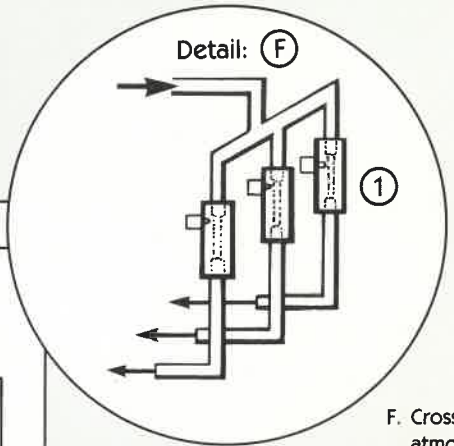
All QR Series furnaces are thoroughly tested at our Scotts Valley facility prior to shipment. Maintenance and instruction manuals accompany shipment. Factory start-up supervision and training are available.

System Hardware

A. Flow Meter Controls
   1. Atmosphere distribution system
   2. Chamber atmosphere
   3. Exit curtain
B. Variable flow powered exhauster
C. Quartz rod hearth
D. Heating panels
E. Water cooling heat sinks

Quick-Response Series Atmosphere-Flow Schematic



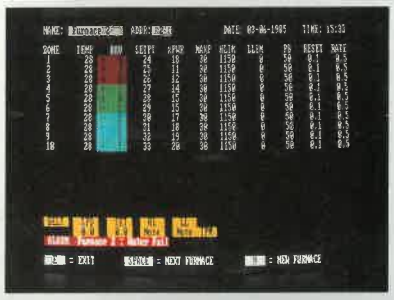


F. Cross-belt atmosphere distribution system
   1. Micrometer regulator valves

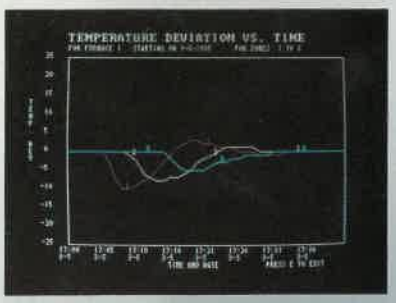
Model WJ-989 Computer Monitoring Control System

The Watkins-Johnson *Quick Response* (QR) Series of conveyor furnaces interface with the Model WJ-989 Furnace Monitor and Control System Network. The WJ-989 System offers the ability to both monitor and control multiple Watkins-Johnson furnaces from either the individual furnace or from a remote, centralized location.

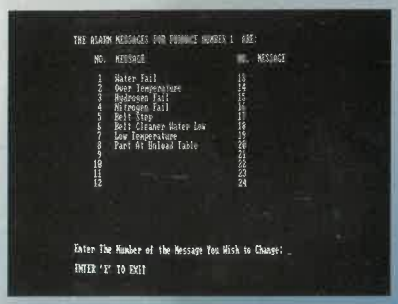
Furnace Monitoring System



Display and Data-logging Mode



Data-logging Graph



Alarm Message Labeling

Design Features

Standard

- 1000°C maximum controlled operating temperature
- Multizone microprocessor-based process controller
- Low-mass ceramic fiber insulation for fast heat-up and cool-down
- Cross-belt atmosphere adjustment
- Powered Venturi exhaust located at entrance of burnout section
- Atmosphere flows counter to belt travel
- Water-cooled exit section
- Conveyor belt speed accuracy of ±½%
- High-temperature Nichrome V conveyor belt
- Overtemperature protection controller

Optional

- Platinel II thermocouples
- Monitoring thermocouples
- Profiling thermocouples
- Conveyor belt cleaner, brush type or ultrasonic
- Temperature recorder
- Dot matrix impact printer
- Thermostatic control of cooling water
- Belt-stop alarm
- WJ-989 monitor and control system interface
- Air dryer
- Side-to-center trim
- Closed-loop belt speed control and digital readout

QR Series Furnace Size Table

Model	Belt Width (in.)	Control Zones	Heated Length (in.)
6QR-73	6	6	73
9QR-97	9	6	96
9QR-121	9	5	120
9QR-145	9	6	145
9QR-169	9	7	169
9QR-193	9	8	193
14QR-97	14	6	96
14QR-121	14	5	120
14QR-145	14	6	145
14QR-169	14	7	169
14QR-193	14	8	193
24QR-121 and up	24	multiple	121 and up
Custom designs	6-25	4-10	48-240

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WATKINS-JOHNSON

Watkins-Johnson Company ■ Stewart Division ■ 440 Kings Village Road, Scotts Valley, CA 95066-4081 ■ (408) 438-2100