

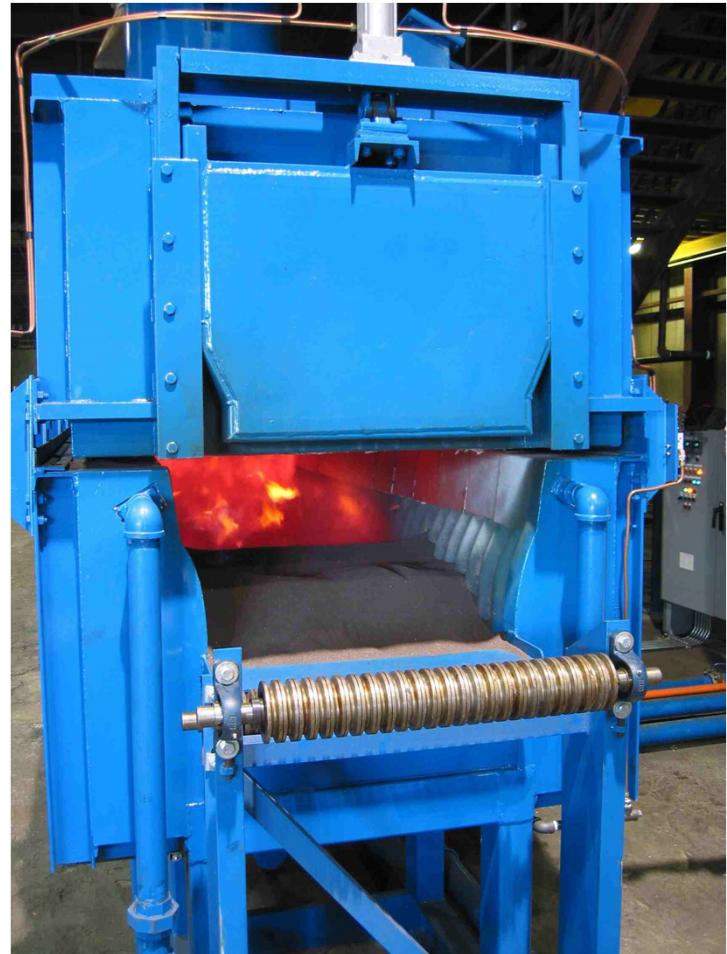
# Fluidbed Furnaces in the Wire Industry

A brief history and look at recent developments in furnace design



## Advantages of Fluidbed Furnaces

- High heat-transfer rate
- Environmentally friendly
- Fast heat-up and cool-down
- New controls are energy efficiency
- New designs offer a rugged low maintenance package



## A Brief Technical History of Fluidbed Furnaces for the Wire Industry



# Early Model Porous Tile Fluidbed

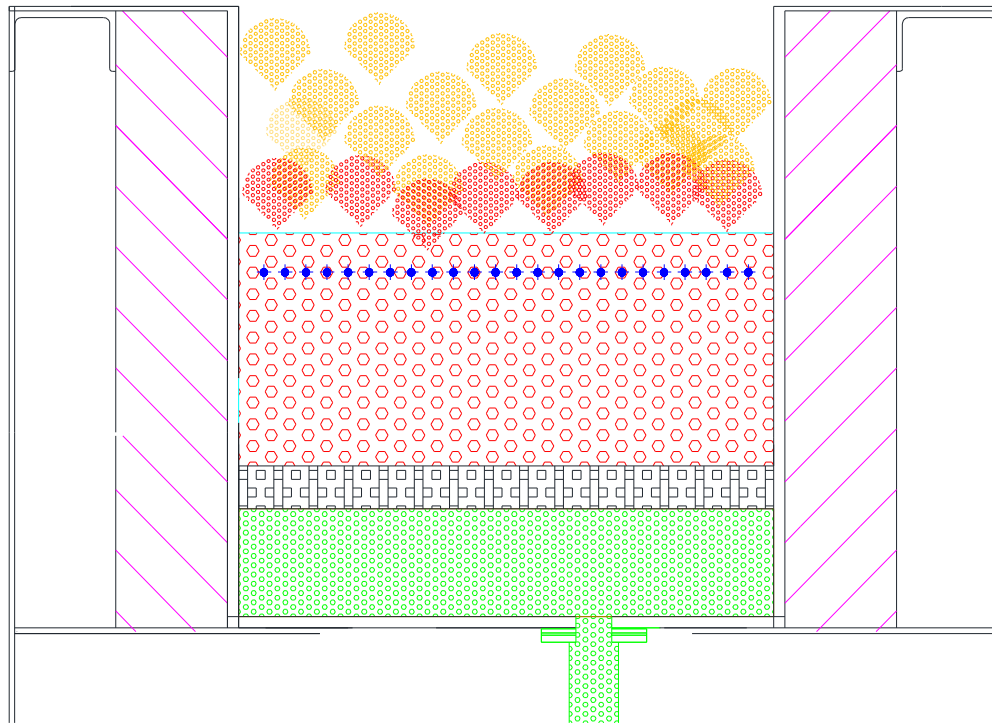
Submerged combustion Fluidbed Furnace  
with porous tile and 100% Pre-Mix

## Advantages

- Simple design
- Uniform fluidization

## Disadvantages

- Cracked tiles result in explosions in the under bed plenum



## Later Model Porous Tile Fluidbed

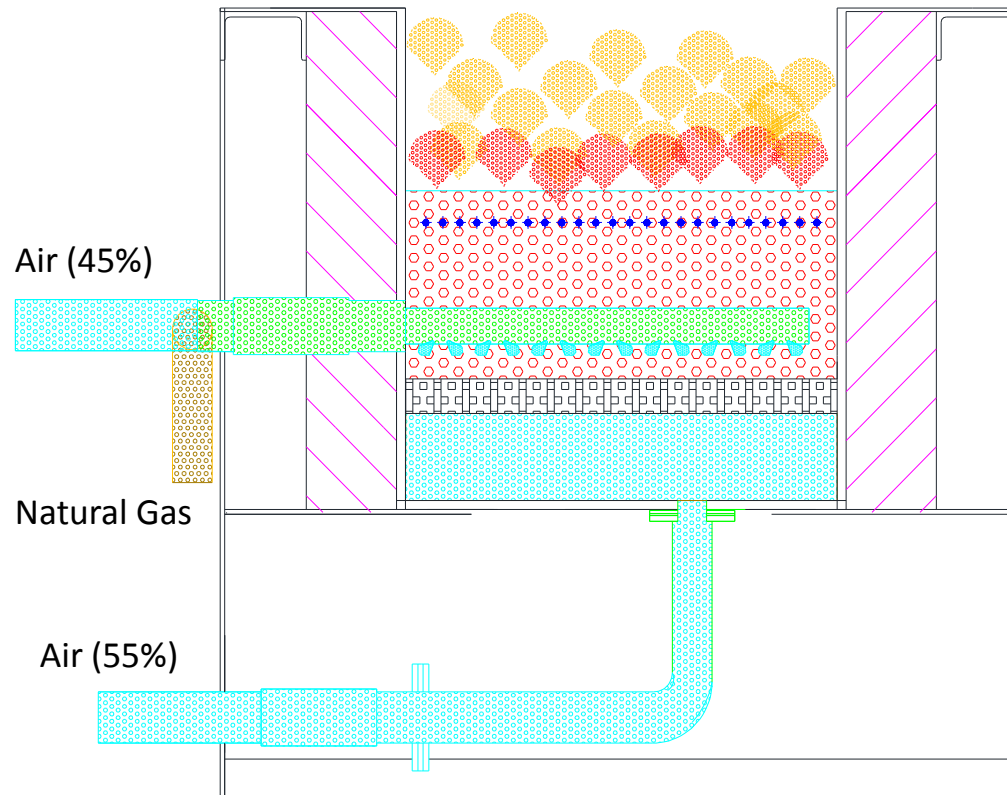
Submerged combustion Fluidbed Furnace with porous tile and single set of burner pipes

### Advantages

- Uniform fluidization

### Disadvantages

- Tiles add to capital cost and maintenance expense
- Through the wall burner piping prone to leaking sand



# Pre-Mix Burner Fluidbed

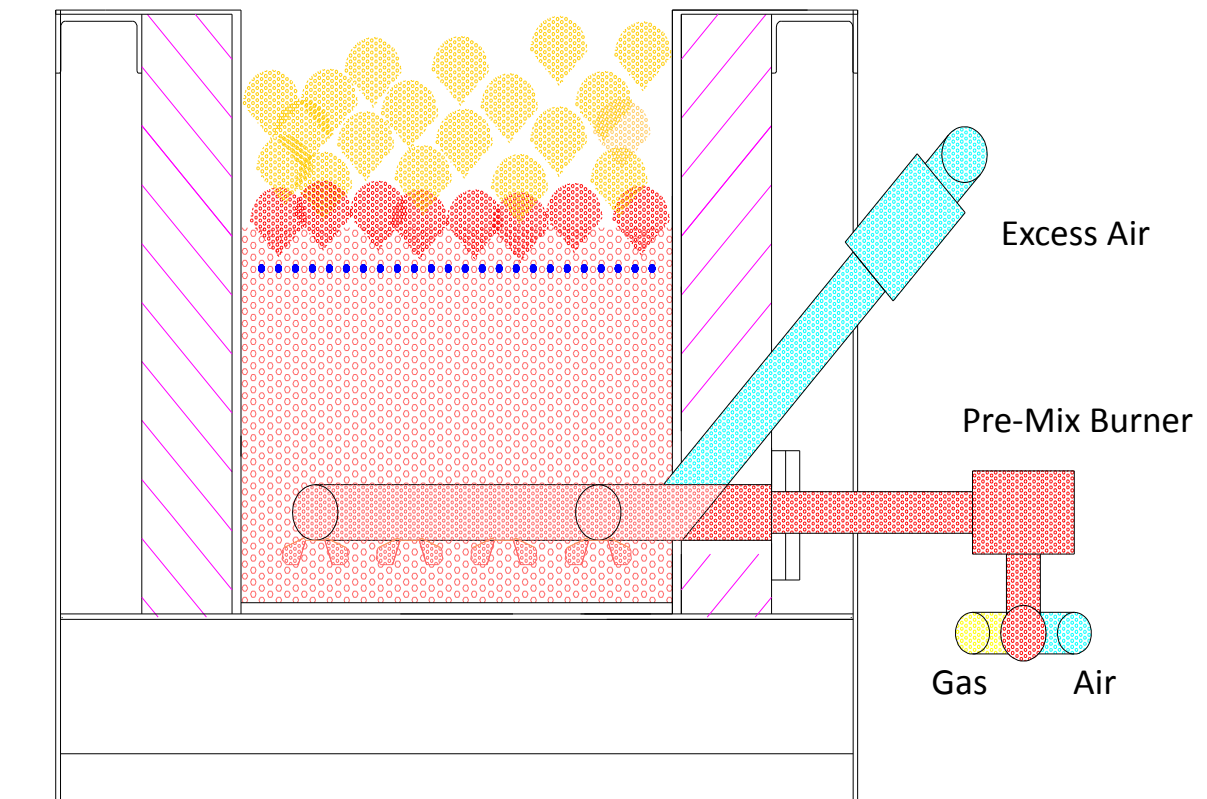
Submerged combustion Fluidbed Furnace  
with pre-mix burner and excess air supply

## Advantages

- No tiles

## Disadvantages

- Overheated burner pipes resulted in some solidification of sand and blocked burner pipes



# Hi-Draw Fluidbed with Dual Fluidizing Tubes

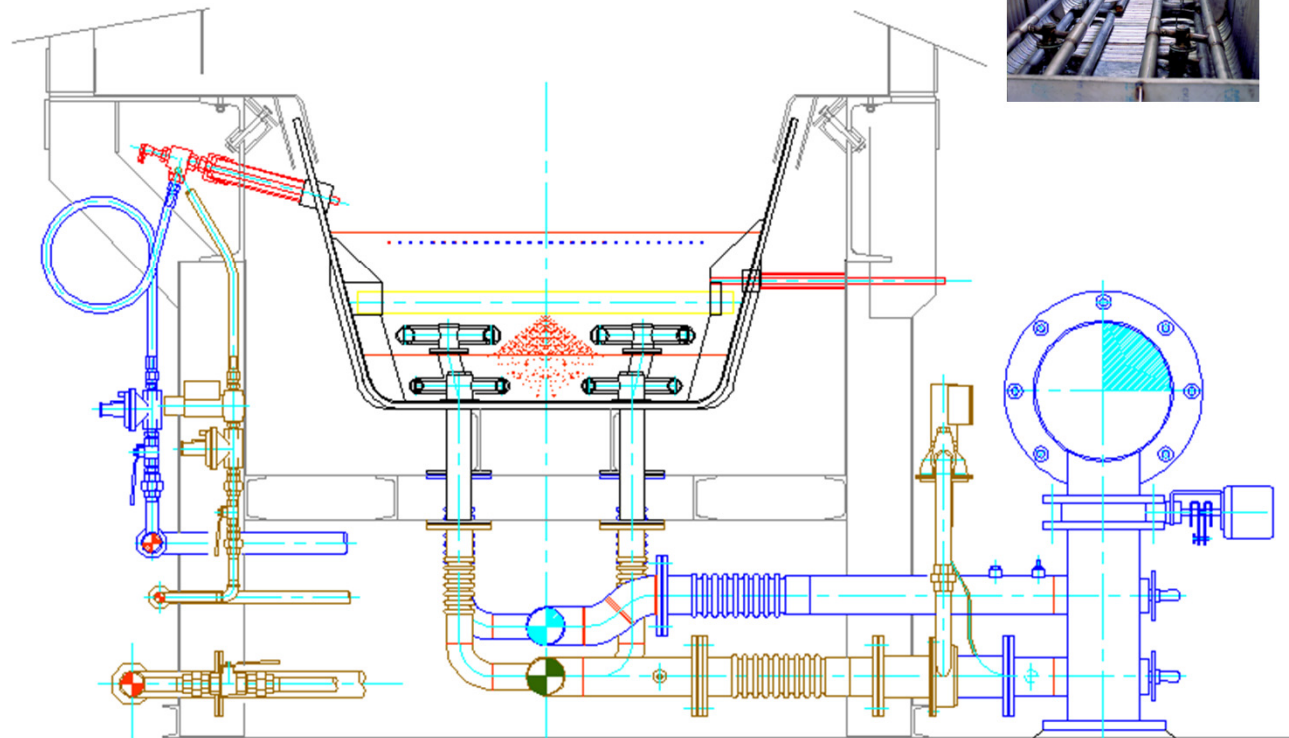
Submerged combustion Fluidbed Furnace with two levels of “race track” shaped burner pipes

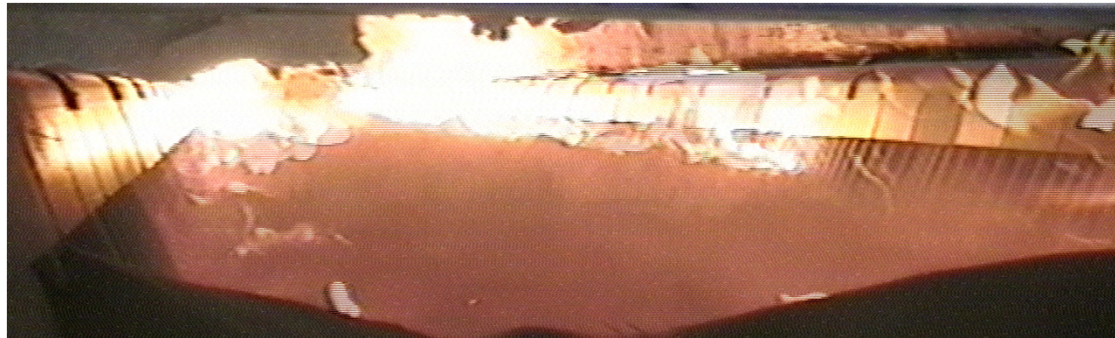
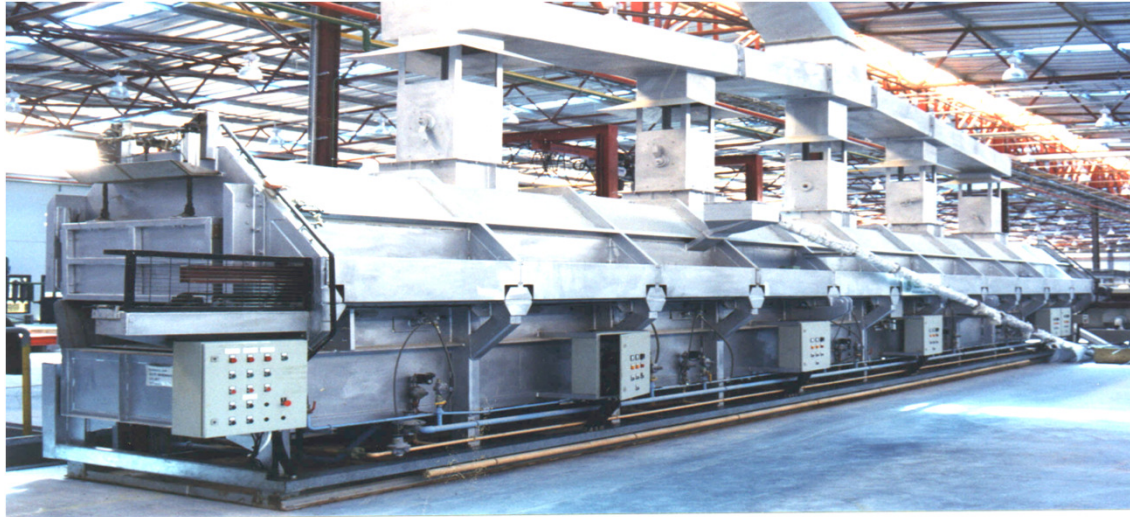
## Advantages

- No tile expenses
- Theoretically self cleaning burner pipes
- Curtain-less threading slot with optional motorized shuttle

## Disadvantages

- “Wall of flame” issue on sidewalls
- Prone to leaking sand and gases through bottom piping connections





Hi-Draw Fluidbed circa 2000



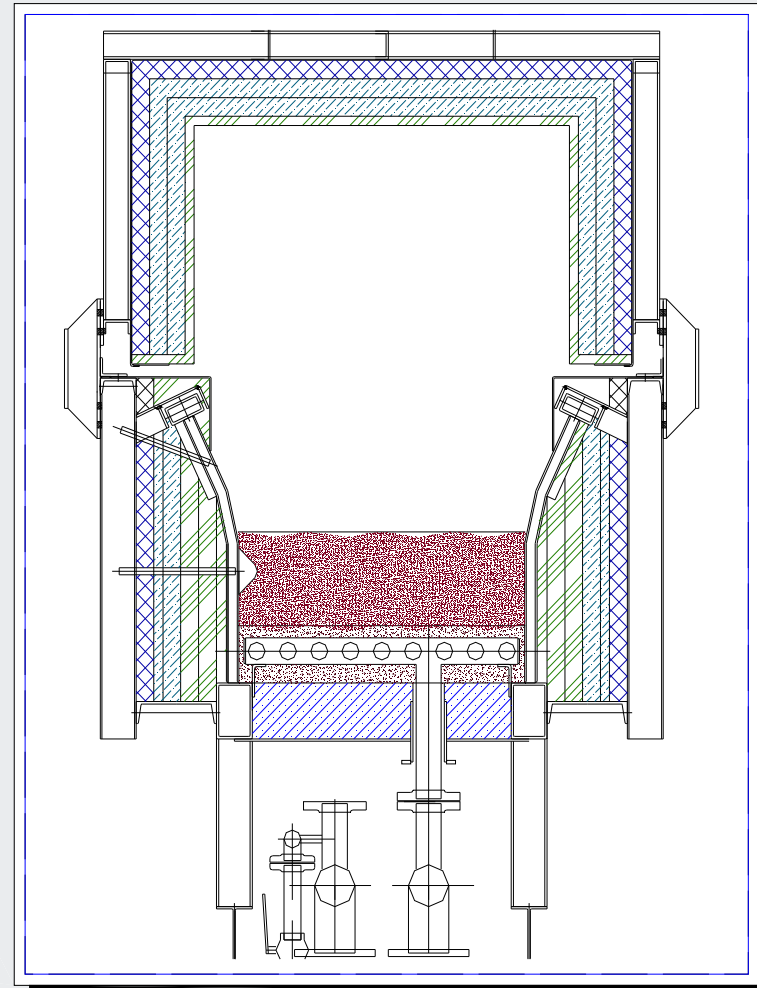
## QED Fluidbed with Interlaced Burner Piping

### Advantages

- No tile expenses
- Uniform fluidization
- New energy efficient proportional control with mass-flow air-gas ratio
- Injected gas system to eliminate flashback
- Curtain-less threading slot

### Disadvantages

- None that we care to admit



## Furnace Design Considerations

Length  $\approx$  Wire Speed (DV)

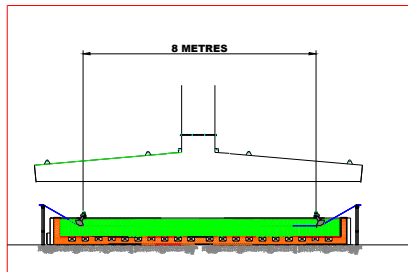
Bed Area  $\approx$  Production Rate (t/h)

Particle Size (sand)  $\approx$  Thermal Input  $\approx$  Production (t/h)

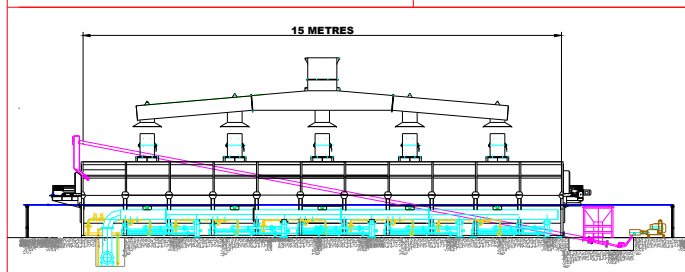


36 Wires, DV= 180, 4.8 tons/h

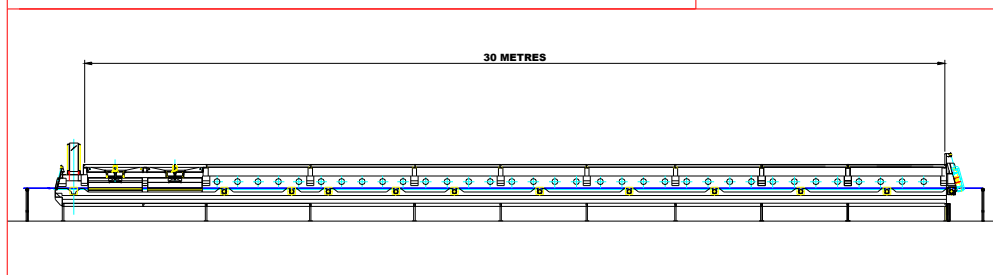
## Comparison of Furnace Lengths DV=200



Molten Lead Bath at 700°C  
8 to 10 meter immersion

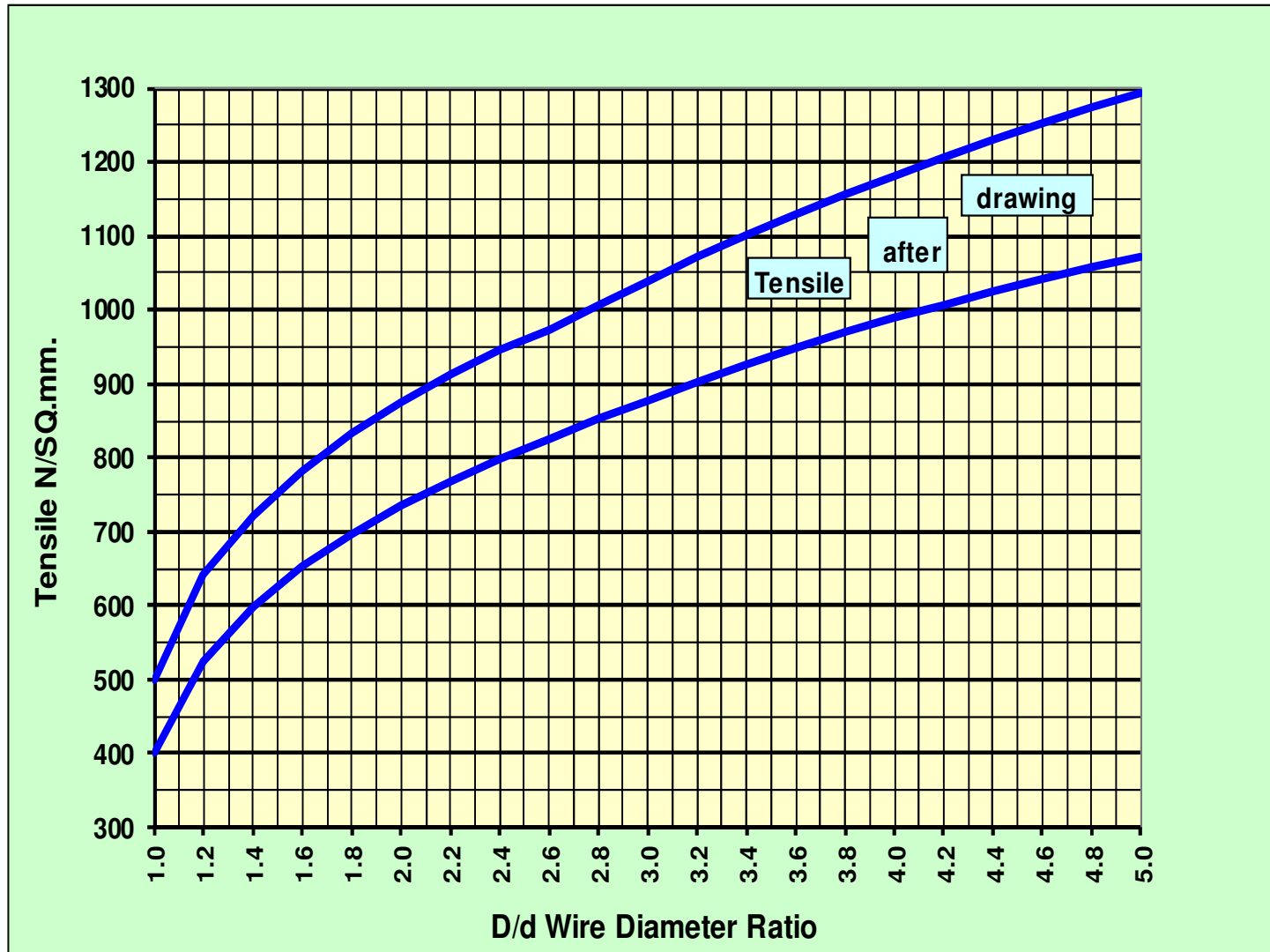


Fluidised Bed at 750°C  
15 meter immersion

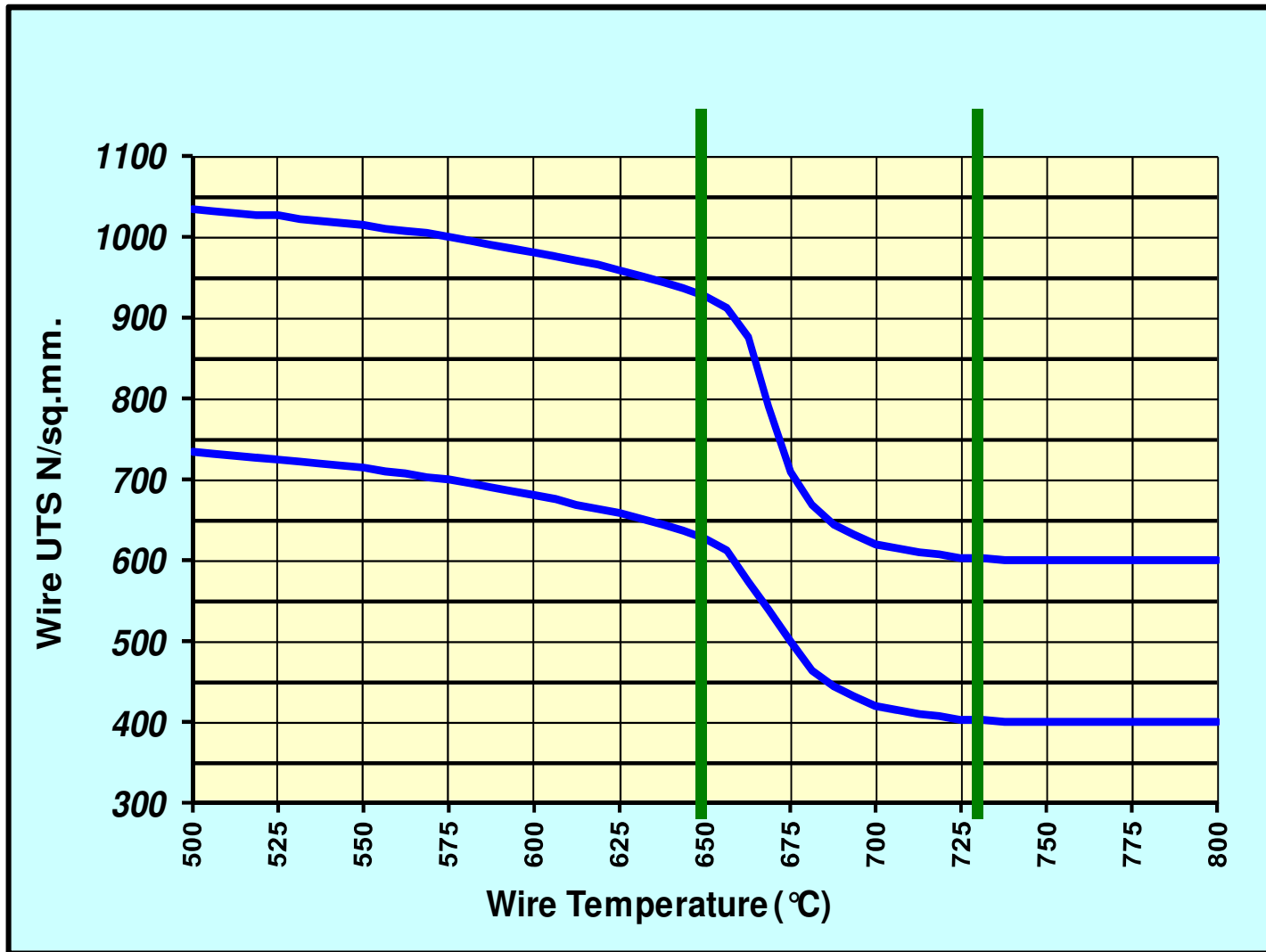


Direct Fired at 900°C  
30 to 40 meter immersion  
(note heat-head)

## Wire Tensile Increase from Drawing

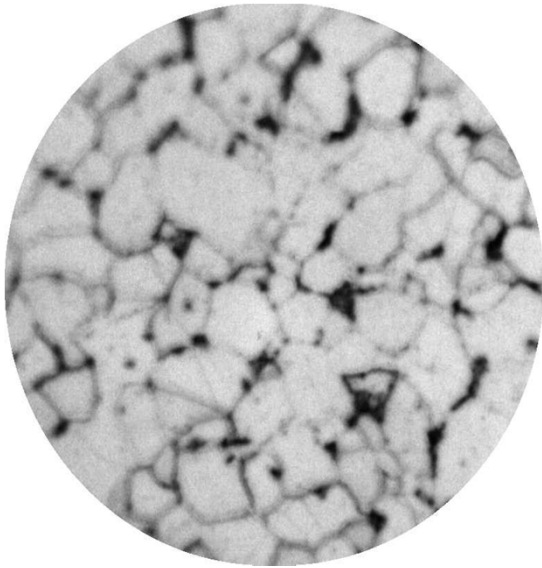


Wire Tensile vs. Annealed Temperature

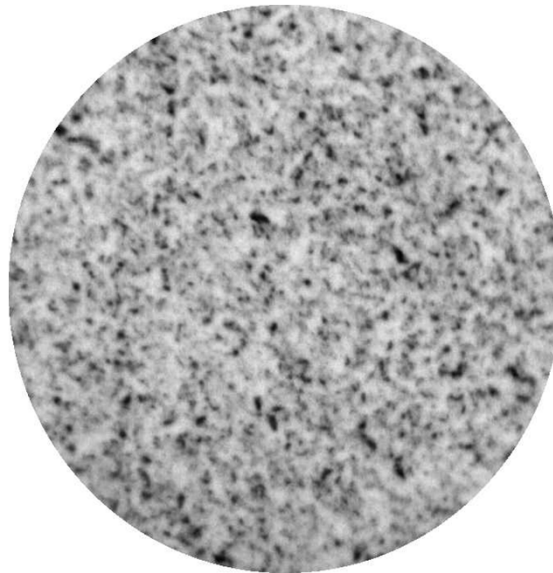


## Rod & Wire Micro-sections Showing Ferrite Crystal Structure

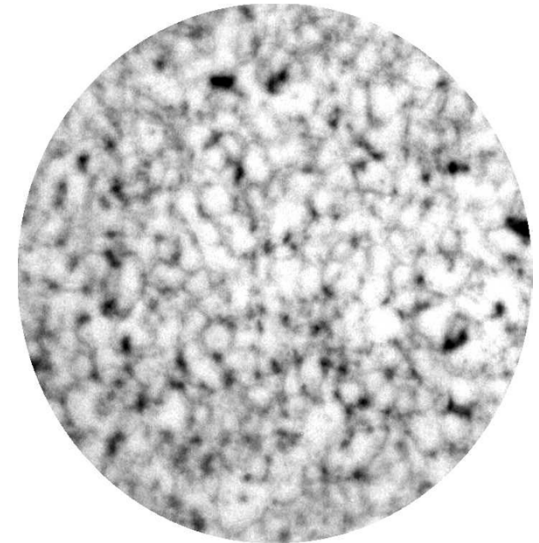
Magnification x 500



Virgin LCS Rod  
5.5 mm diameter  
Tensile = 400 N/sq.mm

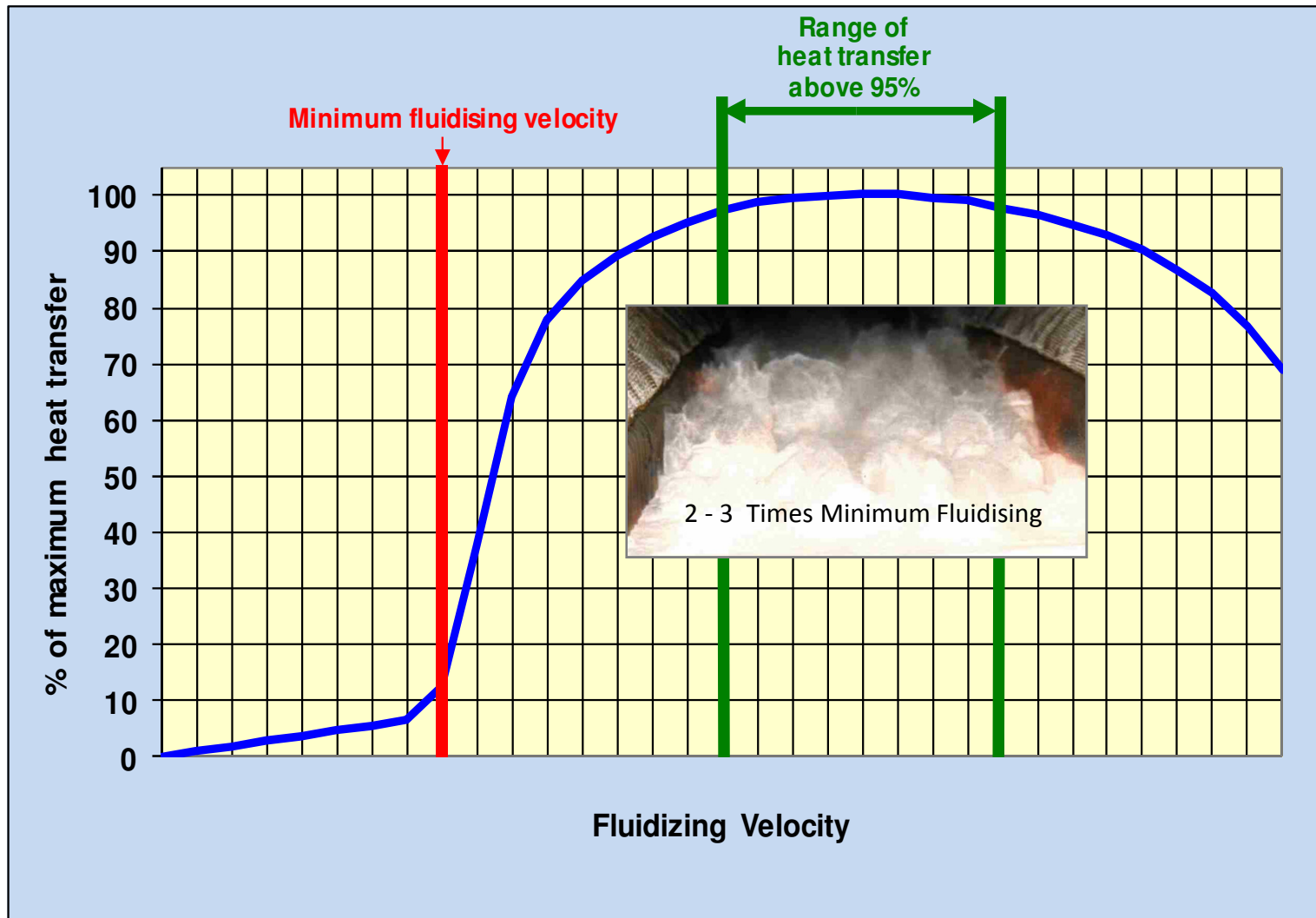


After Wire Drawing  
to 85% area reduction  
2.0 mm diameter  
Tensile = 960 N/sq.mm

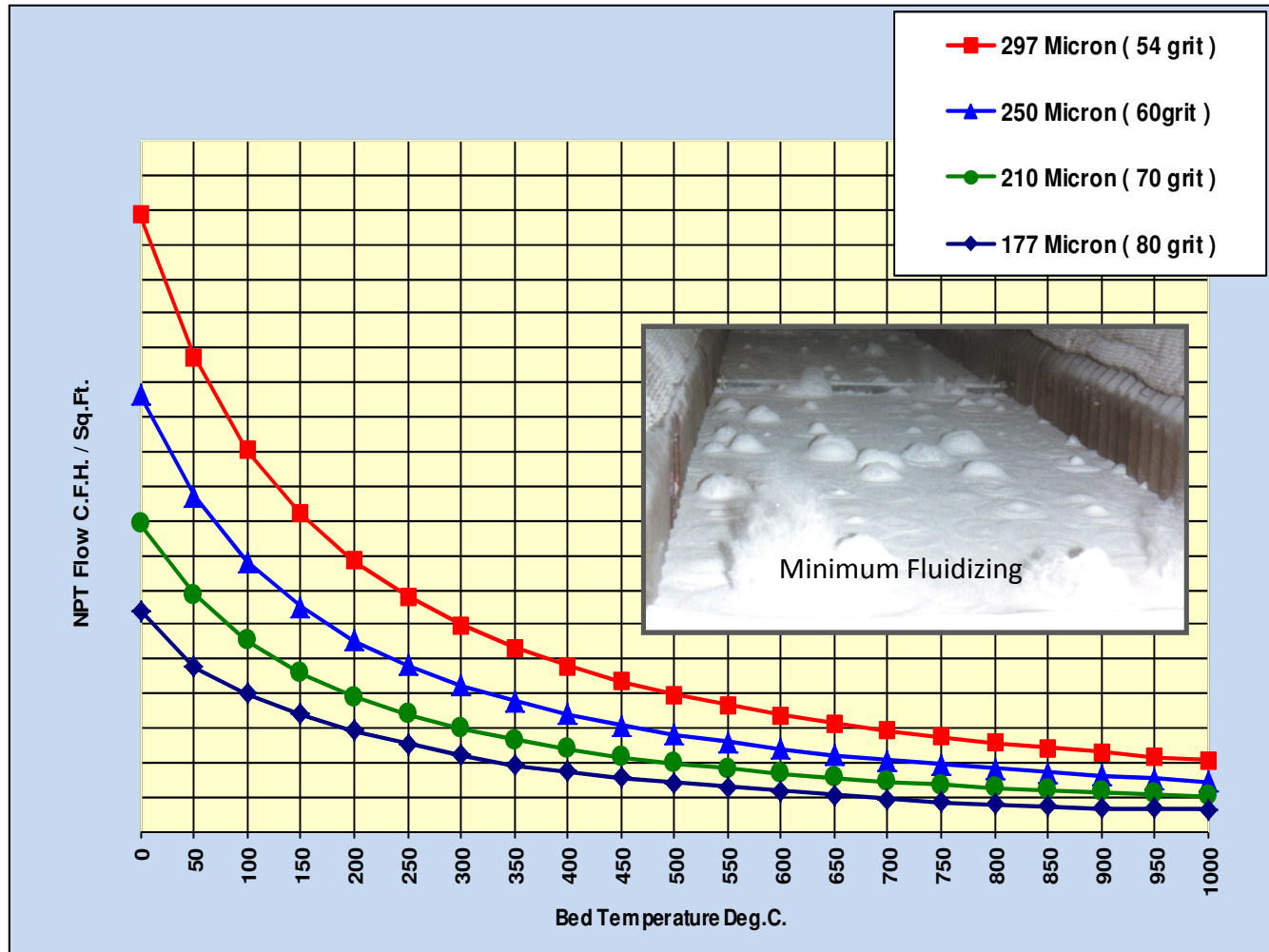


After Stress Relieving & Galvanising  
2.0 mm diameter  
Tensile = 465 N/sq.mm

## Heat-Transfer vs. Fluidizing Velocity



## Minimum Fluidizing Velocity vs. Temperature



## Rugged Sand Systems

### Easy Threading



Double Sand Return System  
with Efficient Air Knife



Threading Slot with  
Special Labyrinth Seal

## Designed to the Latest Combustion & Safety Standards

Mass-Flow Air-Gas Ratio

Digital & Analogue Indication

Top Quality Combustion Components



## Custom Designed to Suit Production



40 Wires, DV= 240 and 8 t/h

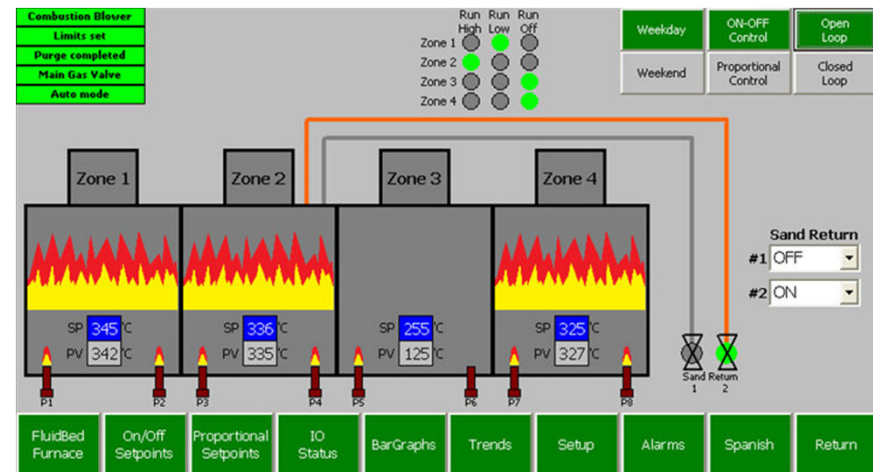


18 Wires, DV= 130 and 1.7 t/h

## PLC's with Multiple Language Options

Closed Loop Proportional Control

Latest Generation PLC's and  
Touchscreens



## Rugged & Dependable Furnaces



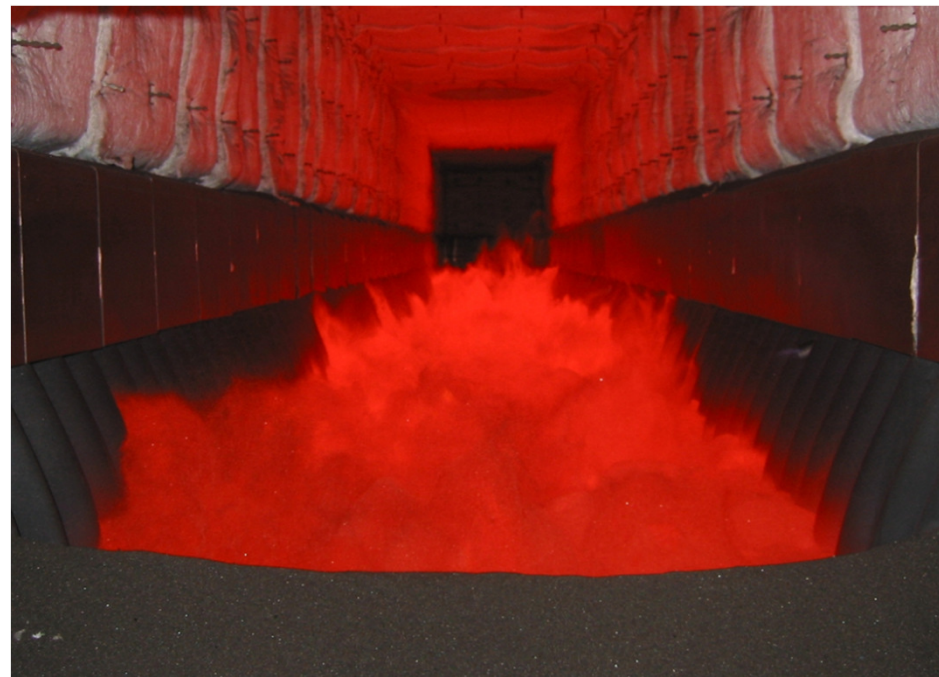
Multiple zone control



50 Wires, DV= 210, 7.0 t/h

## Fluidbed Heat-Treatment Processes

- Annealing
- Austinitizing
- Stress Relieving
- Quenching
- Tempering
- Thermal Diffusion



## Dual Process Fluidbed Furnaces

Low Carbon Annealing at 750°C

Or

High Carbon Patenting with  
Fluidbed Austenitizing at 900°C and  
Lead Quench Furnace at 550°C



## 20 Fluidbeds across 6 Continents

Cavatorta Group	Italy
Corvi Acero S.A.	Dominican Republic
Energys (2)	Egypt
Global Wire	Greece
Guney Celik (2)	Turkey
Heshan Hang Kei	China
Ilke Celik	Turkey
Kiswire	Korea
Malla San	Mexico
Master Halco	USA
Merchants Metals	USA
Mid-South Wire	USA
One SouthWire	Malaysia
OneSteel	Australia
Roofings Ltd	Uganda
Smorgon Wire	Australia
Sinal S.A.	Bolivia
Wei Dat Wiremesh	Malaysia

**Gord Murray**  
VP, QED Wire Lines Inc.



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