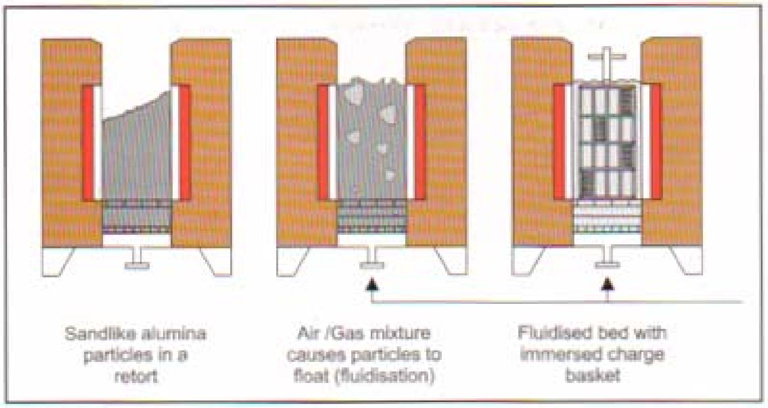
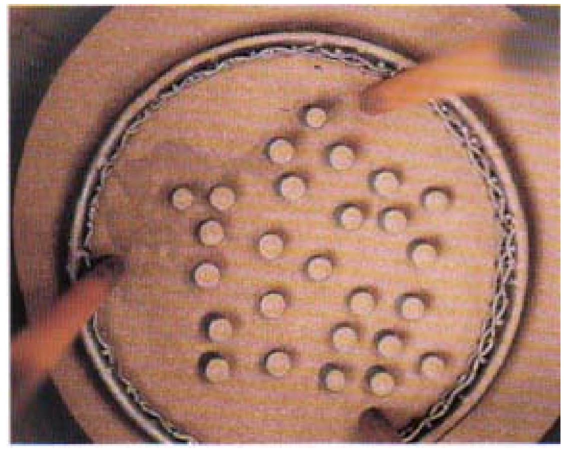
FLUIDTHERM TECHNOLOGY

A HOMOGENEOUS
ENVIRONMENT
FOR
PRECISION
HEAT
TREATMENT

FLUIDIZED BED FURNACES

PRINCIPLE

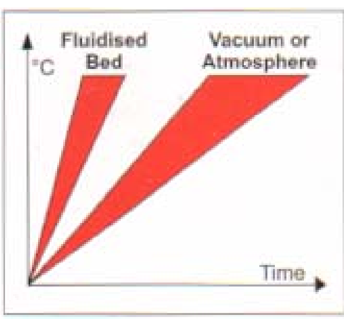




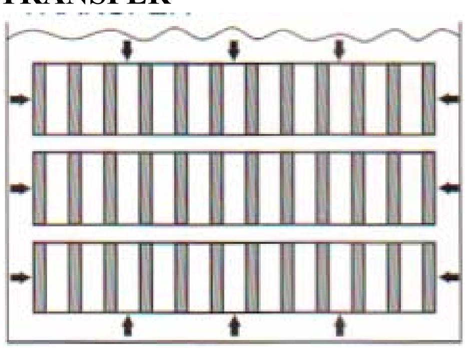
Fluidized bed furnaces employ an alloy retort filled with sand-like alumina particles. When a controlled stream of air or gas is passed upward through a distributor below the retort, the particles float on a cushion of the air / gas stream and move around turbulently without elutriation. The now "fluidized" bed looks and behaves remarkably like a boiling liquid bath. When heated (externally or internally) and when the fluidizing gas mixture is also the required heat treatment atmosphere (neutral or reactive), the fluidized bed becomes an excellent heat treatment furnace for components that are immersed into it.

PROPERTIES

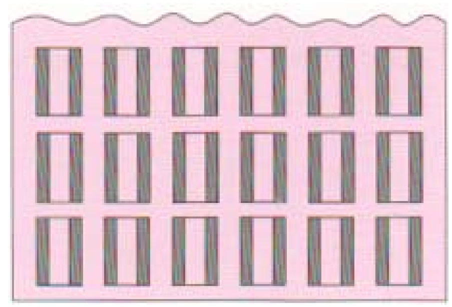
- **RAPID & UNIFORM HEAT TRANSFER**



Higher heat transfer rate and shorter soak time in fluidized bed furnaces compared to batch atmosphere and vacuum furnaces.

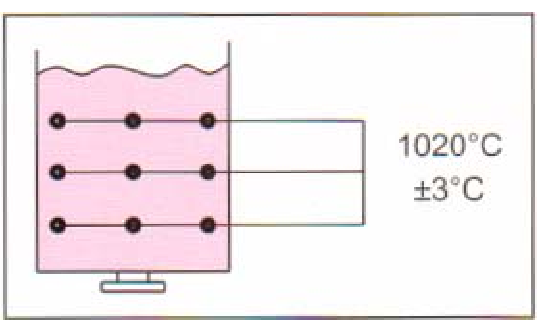


Non uniform heat up rate between components in the basket edges and in the center, in convection assisted radiation batch furnaces.



Simultaneous conductive contact of hot alumina on all surfaces of all immersed components ensures more rapid and uniform heat up rates in fluidized bed furnaces.

- **TEMPERATURE UNIFORMITY**
  Due to turbulent particle movement



- FLEXIBILITY
  Any temperature (Ambient to 1200°C)
  + Any heat treatment atmosphere
  = ALL HEAT TREATMENT PROCESSES IN ONE FURNACE
  RAPID ATMOSPHERE EXCHANGE.
  QUICK STARTUP AND SHUT DOWN.

- **CLEAN, SAFE & NON POLLUTING**
  No toxic effluents, health or explosion hazards

HARDENING & TEMPERING

OF COMPONENTS & TOOLING

LOW DISTORTION DUE TO UNIFORM HEAT TRANSFER

HIGH QUALITY SURFACE FINISH

CONSISTENT HARDNESS

SHORT CYCLE TIME, HIGH PRODUCTIVITY

SUPERIOR TO VACUUM HARDENING!

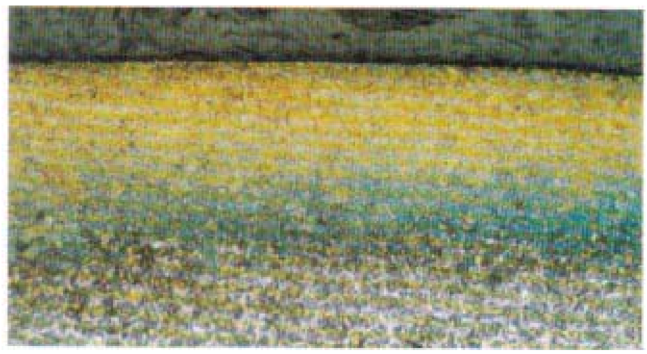
A rational examination reveals that other than for very few applications that require an extremely high degree of surface brightness (eg plastic injection moulds) where no subsequent polishing / grinding is performed, the fluidized bed furnace (which also provides a high quality surface) has the following advantages over vacuum furnaces.

- SUPERIOR HARDENED STRUCTURE DUE TO IMMERSION QUENCHING / MARQUENCHING IN CHOICE OF SEVERAL QUENCHANTS.
- BETTER CONTROL OVER ALLOY PARTITIONING.
- WIDER VARIETY OF STEELS CAN BE PROCESSED.
- SURFACE TREATMENTS IN THE SAME FURNACE.
- EQUAL OR LOWER LEVEL OF DISTORTION.
- MUCH LOWER CAPITAL COST.
- MUCH LOWER MAINTENANCE COST.
- MORE UNIFORM TEMPERING.

In several instances these outweigh the advantages of vacuum furnaces some of which are: Cleaner (than the already clean fluidized bed) environment * Less product handling * Lower gas consumption * No post cleaning * Less floor space.

CARBURIZING AND CARBONITRIDING*

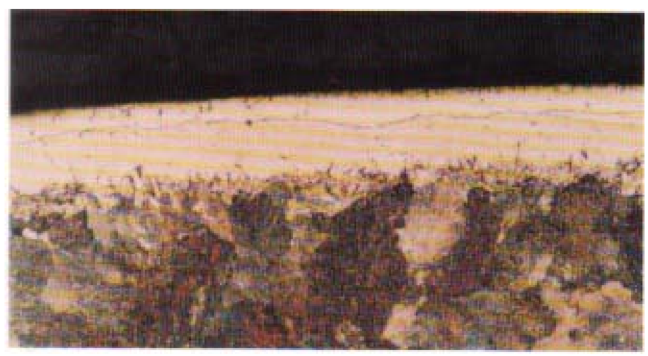
- HIGHER RATE OF CARBON PENETRATION.
- CLASSIC BOOST / DIFFUSE CARBURIZING.
- SHORTER CYCLE TIME.
- CONSISTENT HARDNESS & CASE DEPTH.
- HIGH TEMPERATURE CARBURIZING UP TO 1020°C.
- PRECISE CONTROL OVER SHALLOW CASE DEPTH.
- ABSENCE OF SUB-SURFACE OXIDATION.
- IMPROVED FATIGUE STRENGTH.
- GOOD CASE UNIFORMITY IN HOLES & CREVICES.
- PRECISE CONTROL OVER HARDNESS PROFILE.



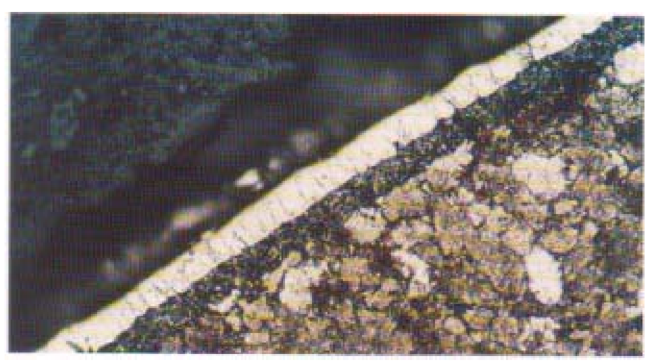
Ck 15. Carburized @ 920°C, 35 mins. 0.35 mm ECD.

CARBURIZING AND CARBONITRIDING*

- SHALLOW CASE NITROCARBURIZING AS IN PROPRIETARY SALT BATH PROCESSES.
- ALSO DEEP CASE NITROCARBURIZING WITHOUT SURFACE CHEMICAL ATTACK AS IN SALT BATHS.
- CLEAN & NON TOXIC PROCESS.
- DEEP CASE NITRIDING, SHORTER CYCLE TIME.
- VARIABLE GAS MIXTURES FOR CONTROL OVER THE NITRIDING POTENTIAL.
- PROCESSING FROM 450°C TO 700°C.
- “NIL TO FULL” SURFACE POROSITY CONTROL.
- MID CYCLE STEAM INJECTION FOR ADHERENT OXIDE LAYER FOR CORROSION RESISTANCE.
- OXYNITRIDING CAPABILITY.
- COMPONENTS ARE TAKEN OUT AFTER NITRIDING OR NITROCARBURIZING IS OVER. NO LONG COOLING CYCLE AS IN SEALED RETORT FURNACES.
- FOR NITRIDING STEELS, OTHER ALLOY STEELS, LOW CARBON STEELS, TOOL STEELS, STAINLESS STEELS, IRONS & SINTERED PARTS.



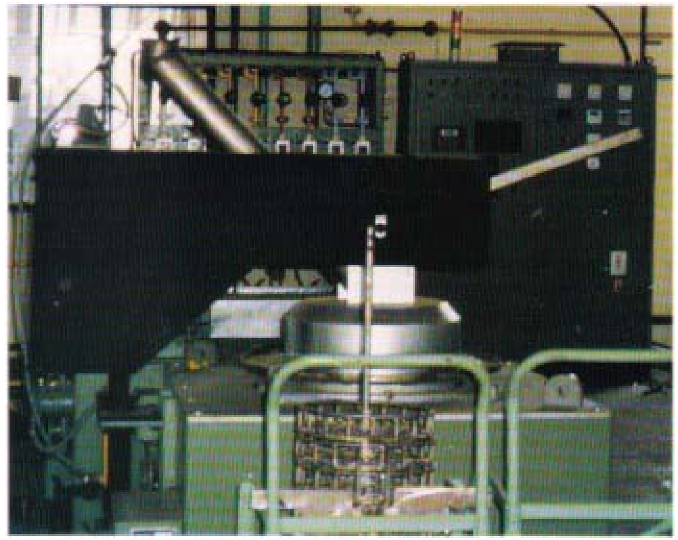
Ck 45. Austenitic Nitrocarburized @ 650oC. Dense compound zone backed by an austenite layer and nitrogen diffusion zone.



Ck 40. Austenitic Nitrocarburized @ 700°C and aged @ 350°C. Porous compound zone, backed by a Iron-Nitrogen bainite layer (Austenite Conversion).

BATCH FURNACES, FEATURES & OPTIONS

- RUGGED CONSTRUCTION.
- DISTRIBUTOR PLATE FOR OPTIMIZED FLUIDIZATION.
- FREE EXPANSION ALLOY RETORT.
- LOW GAS CONSUMPTION.
- AUTO FLUIDIZATION CONTROL.
- AUTO PROCESS CONTROL.
- ELECTRICALLY HEATED OR GAS FIRED FURNACES.
- SiC OR METAL HEATERS.
- THYRISTOR HEATING CONTROL.
- RECUPERATIVE BURNERS.
- SEVERAL SAFETY INTERLOCKS. FULL RANGE OF AUXILIARY EQUIPMENT—FIXTURING, WASHING MACHINES, GRIT BLASTERS, QUENCH BATHS, VIBRATORY SIEVES etc.



CONTINUOUS (LINKED BATCH) PLANTS

One or more batch furnaces can be linked with one or more quench tanks, washing machines and tempering furnaces by a traveling (sealed quench) pick and place hood to / from the FLEXCELL linked batch heat treatment plant.

The configuration can be designed for general heat treatment, continuous carburizing, isothermal annealing and hardening and tempering of components and tooling. The advantage of such a plant is in its ability to operate as a continuous furnace or as individual batch furnaces depending on the load quantity and heat treatment specifications. Production does not stop when one individual furnace is under maintenance. While quenching, the hood is purged with nitrogen as a protective atmosphere for the hot change.

Partial view of a FLEXCELL comprising three hardening furnaces, two tempering furnaces, two quench tanks and one wash machine.

ADVANTAGES

QUALITY. Consistent hardness and case depth due to the high degree of temperature uniformity.

PRODUCTIVITY. Rapid and uniform heat transfer rates, shorter process cycles and increased throughput. Significant reduction in the cycle time of diffusion processes as well. Small furnaces can output a disproportionately high tonnage.

FLEXIBILITY. One furnace can be used continuously for a single component and process or for a variety of components and processes with several process changes in a single day. The ability to operate at any temperature and with a wide variety of gas mixtures allows process fine tuning for different components and custom designing of processes for specific applications.

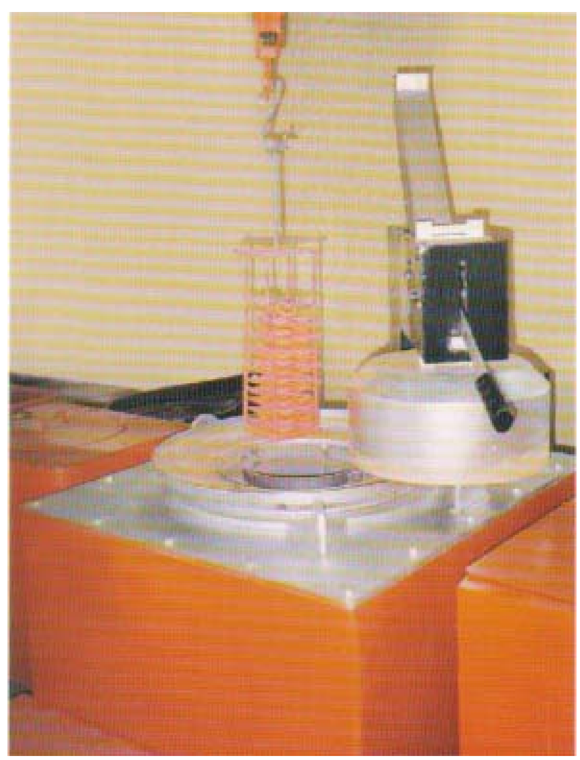
EASY MAINTENANCE. The plant construction is simple without any hot moving parts. No special skills or tooling are required and maintenance can be done in-house.

LOW OPERATING COSTS. Shorter cycles ensure lower heat losses. Consumes gas only when components are being processed. Rapid (2 minutes typ.) atmosphere change allows use of air between batches. The alumina retains heat when the furnace is switched off.

LOW CAPITAL COST. Lowest cost equipment compared to other furnaces of similar capacity and quality of output, including salt baths (with effluent plants and safety infrastructure added).

SAFETY. Fluidized bed furnaces are inherently safe to operate being an open system unlike sealed quench and other atmosphere furnaces. Gas mixtures unsafe at low temperatures in these furnaces present no problem in fluidized beds. Examples are air and ammonia for oxynitriding or air, hydrocarbon and ammonia for nitrocarburizing. Unlike in salt baths, immersion of oily and wet components in a fluidized bed will not cause an explosion and pre-cleaning is not generally required except for certain surface treatment.

NO GAS GENERATORS. The fluidized alumina particles present a large surface area for thermo-chemical decomposition and gas mixtures crack to completion within a short distance of entry into the bed. Separate gas generators for endogas and exogas with attendant capital and maintenance costs are hence not necessary.



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