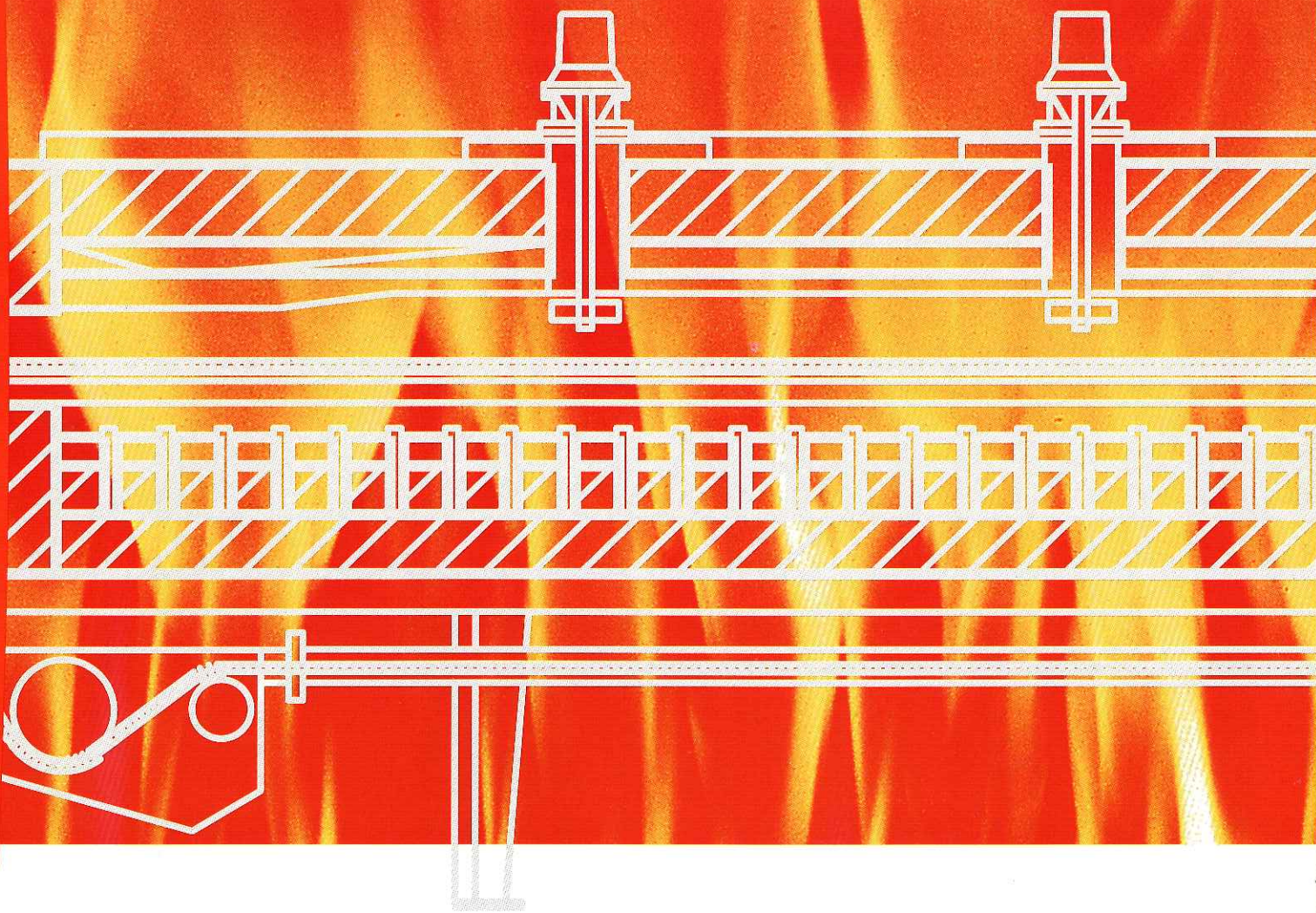


TYPE T MESH BELT CONVEYOR FURNACES

HARDENING, CARBURIZING, CARBONITRIDING...

THE LEADING EDGE IN HEAT TREATMENT.



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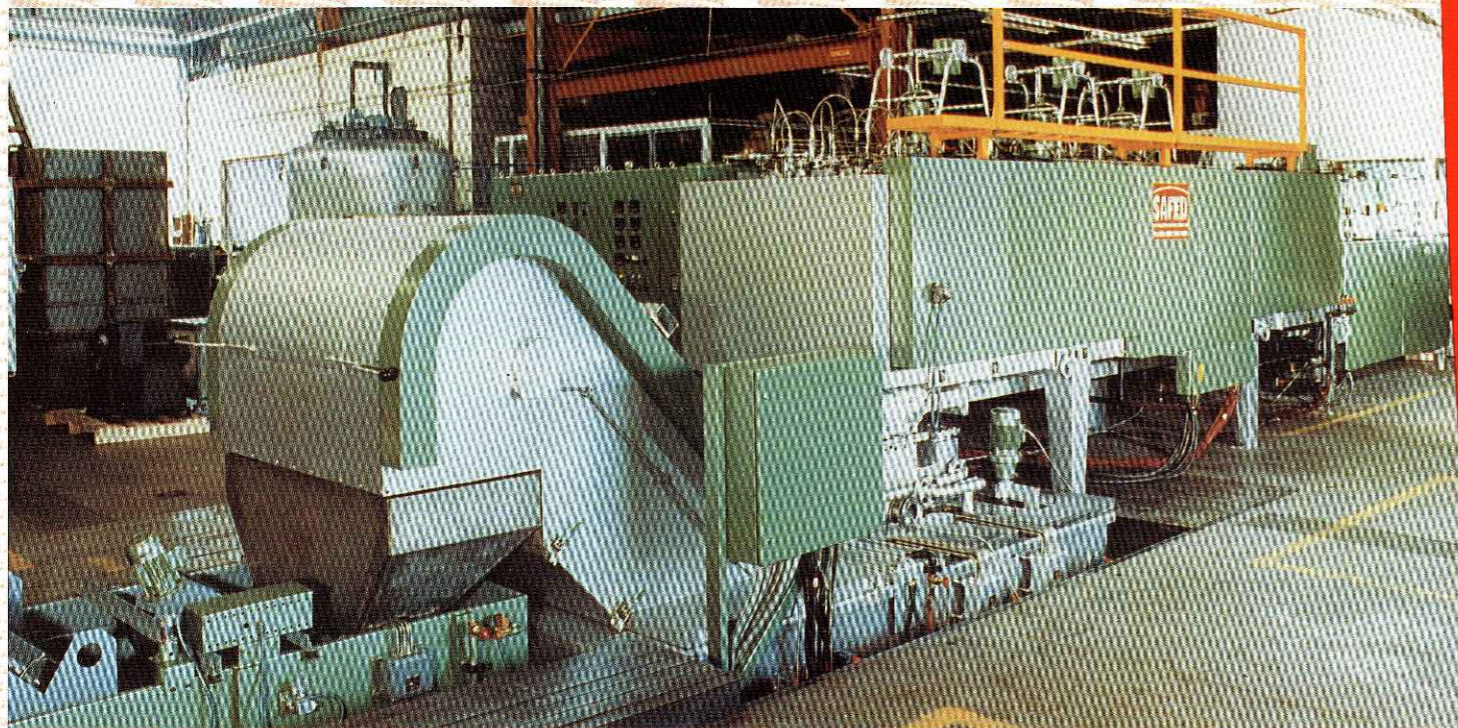
OPTIMISED CONCEPT.

Type T mesh belt conveyor furnace is based on a unique concept that has proven its worth in hundreds of applications. The gas-tight muffle, moving hearth plate and belt drive mechanism are fundamental components of SAFED's tried-and-tested design. As a result of its steady stream of improved features and new models, SAFED is now able to supply a whole range of advanced systems in numerous different versions. There are furnaces of the right capacity for all applications, from small-scale to large-scale production, and with a choice of electrical or gas heating.

Modern heat treatment methods for mass-produced steel parts place considerable demands on the processes used. This is where SAFED's type T mesh belt conveyor furnace is simply beyond compare. Its design principle and wide variety of unique technical features bring many benefits for the user :

- Reliable processing parameters;
- Reproducible high standards of quality within very narrow tolerances;
- A long operating life that pays back the original investment many times over;
- Economical processing as a result of low running costs and a versatile operating principle;
- Low energy and operating materials consumption for minimum environmental impact.

Type T 80/54 furnace with salt-bath quenching for austempering; electrically heated.



Type T furnace is designed for continuous heat treatment of mass-produced and limited run parts, and can

easily be integrated into the total production process.

ON HOME GROUND.

The high precision and reproducible standards of this process mean that the required metallurgical and mechanical properties can be achieved on a wide range of parts. The plant is ideal for the following applications:

- Mass-produced parts for the automotive industry;
- Screws and other fastenings;
- Antifriction bearing components;
- Fine-blanked parts and deep-drawn components;
- Components for drive chains;
- Tools such as saw blades, drills and screwdrivers;
- All kinds of small components.

As the process parameters of the Type T furnace can be controlled precisely, it is suitable for a wide variety of heat treatment methods.

- Hardening by quenching with oil, water solutions and polymer;
- Hardening, carburizing and carbonitriding;
- Austempering and martensitic hardening in a salt bath;
- Nitrocarburizing by the SAFED OXYCAD method.

The Type T series can easily be combined with other production equipment to form an automated processing line. Systems tailored to individual needs can also be supplied.

Plant Type T 80/54 for carbonitriding screws: output approx. 370 kg/h; gas-heated.



Type T furnaces satisfy the high quality requirements for processing mass-produced metal components in a protective atmosphere.

MADE BY EXPERTS.

The optimised design of this furnace, which incorporates extensive monitoring and control technology, ensures that all processing parameters are handled with reproducible high precision. The key to controlled treatment in a protective atmosphere is a gas-tight muffle made from heat-resistant alloy steel. This component forms the basis of the zone-controlled heating chamber, and ensures that a stable atmosphere is established very rapidly.

A further advantage of this type of plant is the special belt drive system. This device significantly extends belt operating life and allows the processing time to be regulated accurately and reproducibly. The plant's overall concept is specifically geared towards the economical, pro-environmental heat treatment of high-grade mass-produced parts.

Drive mechanism

The drive mechanism, developed and patented by SAFED, ensures that the conveyor belt moves in defined manner. With each forward stroke the movable hearth plate, mounted on rollers, carries the conveyor belt forward through the muffle. This principle ensures that the belt passes through the gas-tight muffle

and down the chute without becoming stretched or distorted, significantly reducing its rate of wear. As all mechanical parts are located outside the furnace, they are not susceptible to wear as a result of thermal stress.

Loading table

Workpieces can be individually positioned on the belt or simply loaded in bulk.

Flame curtain

Flame curtain with ignition burner and flame monitor.

Conveyor belt

Wire-mesh belt of heat-resistant alloy; various versions available, depending on the type of part being processed.

Thermal insulation

This high-grade composite lightweight insulation keeps thermal losses to a minimum and assures rapid heat up.

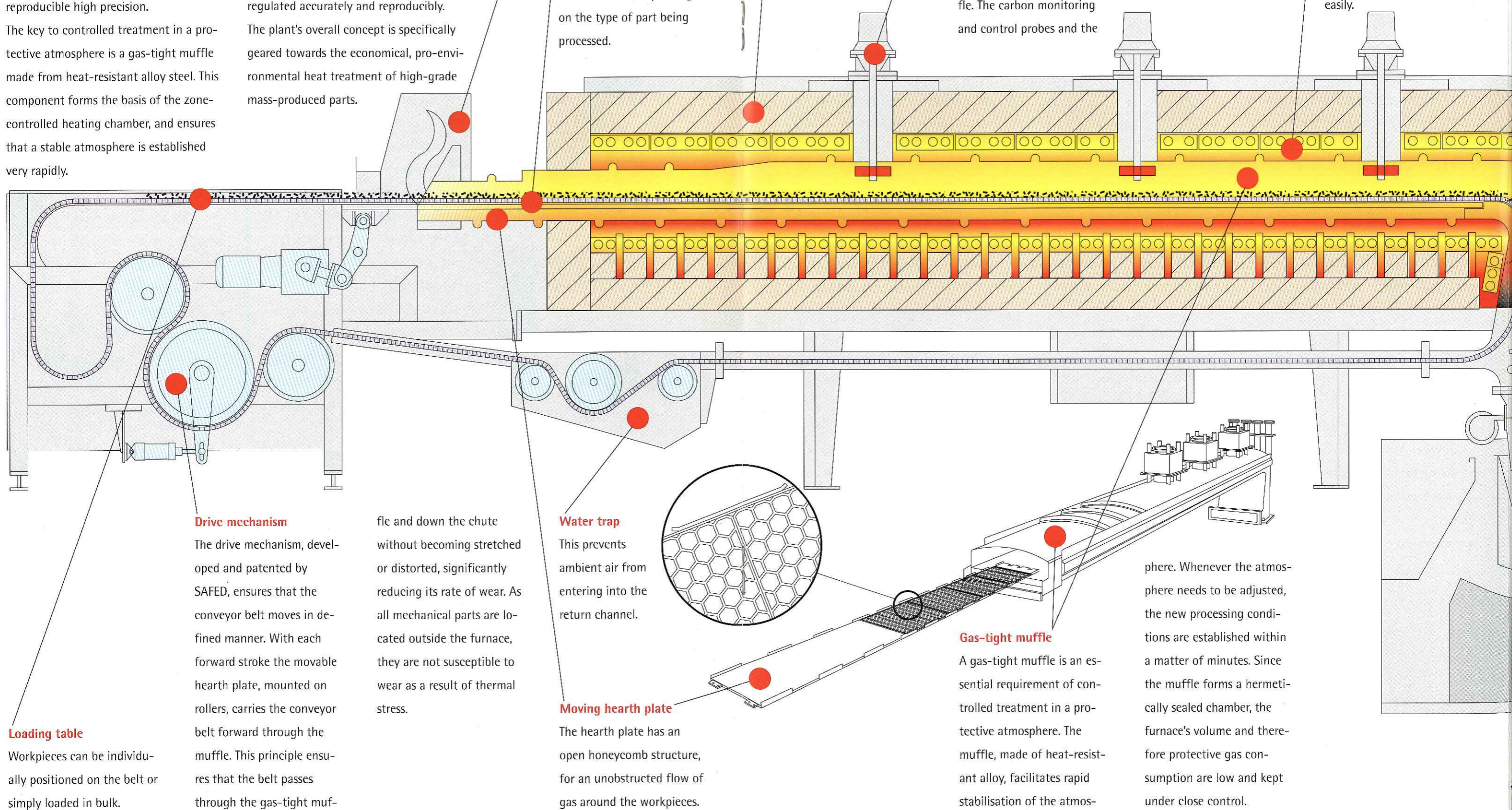
Gas circulation devices (TURBO version)

Type T furnaces usually have one or more gas circulation devices, for precise control of the individual treatment zones. The compact, self-contained turbo units are flanged gas-tight onto the muffle. The carbon monitoring and control probes and the

inlets for the addition gas are also located here. Controlled atmosphere circulation ensures that the entire surface of each workpiece has a uniform supply of the atmosphere.

Heating system

The SAFED range comprises furnaces with either electrical or gas heating. The electrically heated furnaces have heating elements mounted on ceramic tubes in the furnace base, top and chute; these elements can be changed easily.



Water trap

This prevents ambient air from entering into the return channel.

Moving hearth plate

The hearth plate has an open honeycomb structure, for an unobstructed flow of gas around the workpieces.

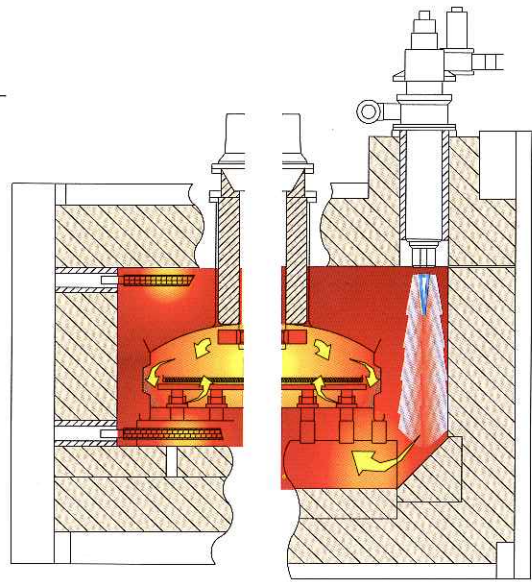
Gas-tight muffle

A gas-tight muffle is an essential requirement of controlled treatment in a protective atmosphere. The muffle, made of heat-resistant alloy, facilitates rapid stabilisation of the atmosphere.

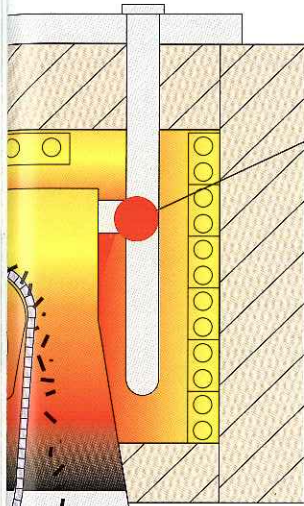
Whenever the atmosphere needs to be adjusted, the new processing conditions are established within a matter of minutes. Since the muffle forms a hermetically sealed chamber, the furnace's volume and therefore protective gas consumption are low and kept under close control.

The chute is heated, to prevent the treated parts from cooling prematurely. The heating elements are arranged in various individual zones, allowing the temperature to be precisely controlled. The perfected monitoring and control technology guarantees that the actual temperature is kept to the desired

settings. High circulation occurs in the heating chamber of **gas-fired** furnaces due to the use of several high-speed burners. The furnaces incorporate leading makes of burner, with recuperators and advanced technical concepts.

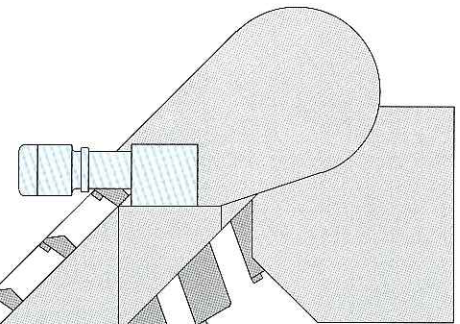


With electrical or gas heating



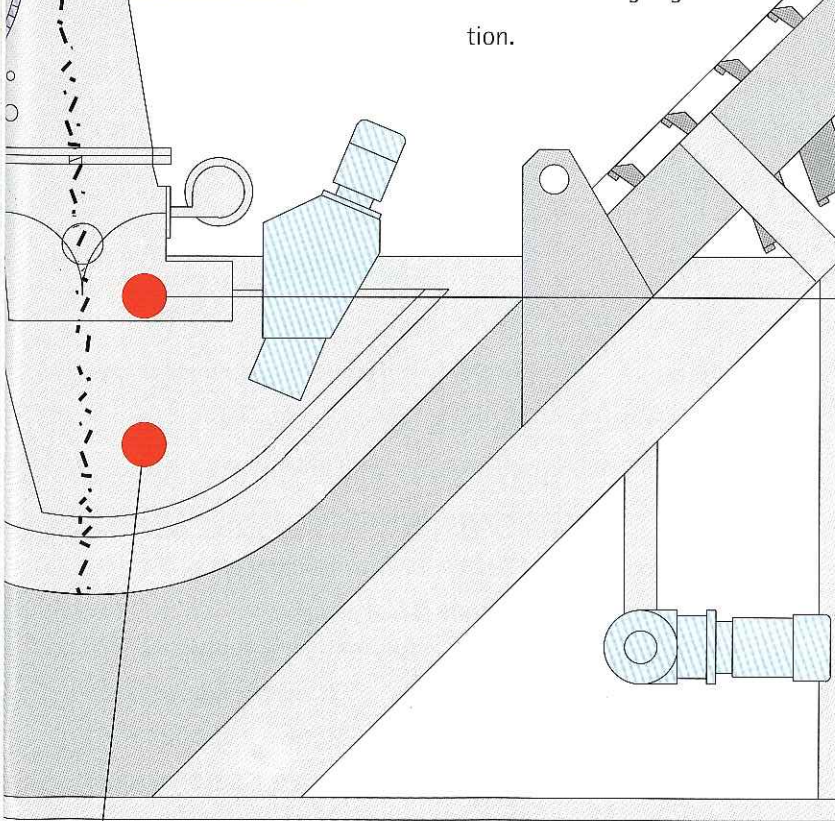
Direct gas delivery (SAFED Injector)

The SAFED Injector System, assures a built-in supply of a precisely controlled carrier gas; it is compact, energy-saving and largely maintenance-free, and is available for either methanol dissociation or endogas generation.



Quenchant curtain

The quenchant curtain positioned between the chute and quench tank prevents rising vapour from entering into the muffle.



Integral quench

There is a choice of versions for the standard quenchant tank. Bucket-chain and belt

extraction versions are just two of the many options available.

A number of quenching systems are available; the right quench for any given application depends on the na-

ture and type of the parts being treated, the properties required and the quenchant used.

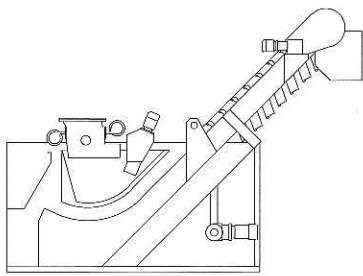
SYSTEMS FOR EVERY APPLICATION.

Quenches for oil, polymer or water

Level control, temperature control, heating, cooling and controlled agitation of the quenchant are standard features on all quenches.

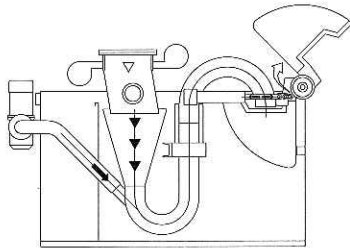
Type G quench

Type G quench is suitable for hardening a wide range of parts. Continuous discharge by means of bucket-chain conveyor, belt conveyor or a magnetic conveyor. Various depths in oil are possible, depending on the parts' dimensions. Special double-tank version for oil-and-water quenching, or for hot-oil quenching up to 200 °C.



Type P quench

The SAFED "pump system" is suitable for hardening small to micro parts. The positive-flow discharge of parts along a tube makes use of the quenching fluid's movement. This principle helps to optimise consistency and maximise quenching speeds, and the plant is very compact.



Salt-bath quenching

Quenching in molten salts produces highly consistent hardening results, as no vapour phase occurs. Two basic principles are used:

Austempering

Bainite conversion is achieved by quenching above M_s , within the 250–400 °C range, and holding at this temperature. The advantage of bainite hardening compared with conventional tempering after

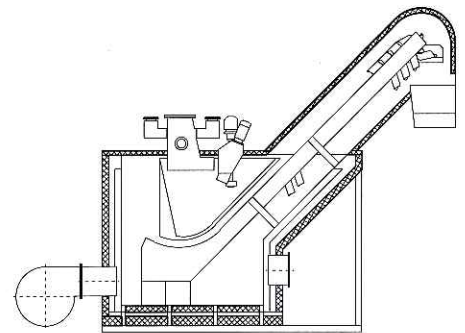
hardening is that it imparts greater toughness and fatigue strength, an important consideration for parts that are safety critical.

Martensitic hardening

Hardening takes place below M_s , within the 160–250 °C range, at a speed that is sufficient to establish a fully martensitic structure with low distortion.

Type GS salt-bath quench

This purpose-designed quench from SAFED has a high-performance heating and cooling system, efficient thermal insulation and a heated, insulated hood over the parts discharge system, to prevent heat losses.



The entire concept, and in particular important functions such as bath heating, discharge, bath agitation and salt curtain, is based on devices that are specially designed for applications involving salts. After the salt quenching process, the parts are rinsed in water.

Controlled atmosphere

In addition to SAFED's mature furnace designs, which guarantee reproducible processing results, we also supply generator systems for all conventional protective gases.

Direct gas delivery, SAFED Injector

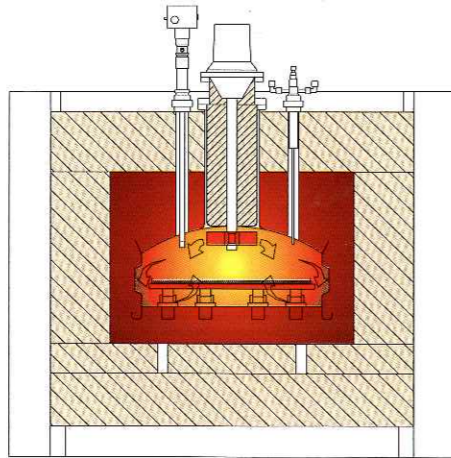
The SAFED Injector System for direct gas delivery - Injector M is for methanol dissociation and Injector N for endothermic gas generation - is a compact, energy-saving device incorporated into the furnace chamber. The protective gas is generated in a retort with separate heating control, fitted at the muffle end. The protective gas is thus instantly available preventing the cooling of the parts and formation of soot in the muffle. The base products are delivered via a mixing station with automatic control.

Conventional gas supply, SAFED protective gas generator

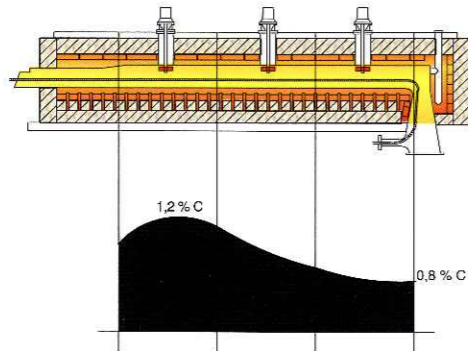
SAFED supplies a full range of conventional gas generators for the most common protective gases, such as endothermic and dissociated methanol.

Carbon potential control

The controlled recirculation of the furnace atmosphere is essential for accurate



regulation of the carbon level. The furnace should ideally be equipped with several gas circulation devices (SAFED Turbo System) which, in conjunction with the carbon monitors, allow the individual processing zones to be accurately con-



trolled. The probes for the carbon monitors and the inlets for delivery of the auxiliary gas are located near the gas circulation devices. Oxygen probes have proven effective for this application, but other conventional systems can also be used. If several turbo circulation devices are fitted, it is possible to establish a defined carbon profile over the furnace's entire length.

Automatic process control

Reproducible, automated processes require regulating and monitoring of all process parameters. Leading makes of PLCs are fitted as standard on SAFED plants to control, to regulate and monitor the principal operating parameters. At the next level, a process control system (operated via PC) can be used. The control system is linked to one or more furnace PLCs via field-bus systems.

Safety devices

Type T furnaces satisfy all relevant CE safety directives and comply with all industrial and environmental safety criteria. The design is regularly reviewed in the light of new findings and the state-of-the-art, particularly with a view to facilitating its operation and maintenance.

Technical data - standard range

Type	Useful dimensions			Power ratings		Throughput
	Belt width	Height	Heated length	Electric heating	Gas heating	approx.*
	mm	mm	mm	kW	kW	kg/h
T 25	150	50	1500	24	—	25
T 30	220	50	2100	36	—	50
T 40/25	300	75	2500	54	—	80
T 40/36	300	75	3600	70	—	120
T 60/36	450	75	3600	120	160	190
T 60/54	450	75	5400	150	190	300
T 80/36	600	100	3600	150	210	260
T 80/54	600	100	5400	190	240	400
T 80/72	600	100	7200	230	270	540
T 120/54	900	100	5400	270	420	620
T 120/80	900	100	8000	320	490	930
T 160/54	1200	100	5400	360	540	800
T 160/80	1200	100	8000	460	700	1200

*Guideline values for carbonitriding, case depth 0.1 mm

Ancillary equipment for integration into automatic heat treatment lines

Type T furnaces can be linked up to other equipments to form an automated process. Every production line is designed individually, to suit each user's specific requirements and the available floor space.

All the SAFED units listed below are compatible with each other and meet exacting standards of reliability:

- Automatic loading systems, matched to the parts being processed and the preceding production stages.
- Continuous degreasing plants, available as drum and conveyor versions,

for aqueous cleaning of parts before and after hardening.

- Mesh belt conveyor tempering furnaces, with air circulation or shield gas, precisely matched to the output of the hardening furnace.



Heat treatment line with automatic loading, degreasing before and after hardening, and tempering furnace.