

MANUAL OF OPERATION  
for

FURNACE TYPE: VBQ-S-303648  
SHOP ORDER: 12069  
SERIAL NUMBER: 16636

Prepared for: International Gear Corp.  
9000 Precision Dr.  
Indianapolis, IN 46236

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07/05/1990 (1)

## DESCRIPTION OF THE VBQ

### 3.1. Furnace

The VBQ furnace is unique in that it is a combination vacuum furnace, controlled atmosphere furnace, and an air furnace.

#### \*NOTE

HIGH SPEED STEELS ARE NOT TO BE INCLUDED, SINCE THE MAXIMUM CONTINUOUS OPERATING TEMPERATURE OF THE VBQ IS 2000°F

### 3.2. Vacuum Vessels

The Hayes Model VBQ-S is a single stage heat treating furnace which may be used for carburizing and hardening tool steels. The furnace consists of a horizontal inner vessel surrounded by an outer water jacket. A rear mounted fan circulates the inert gas backfill through the work load during the cooling cycle.

### 3.3. Front and Rear Heads

The loading end of the furnace consists of a water cooled dished head with a rectangular sliding door which is sealed to the door frame by an 'O' ring. The rear water cooled dished head supports the gas circulating fan and the heat exchanger.

### 3.4. Heating Chamber

The heating chamber is a steel framework fabricated with appropriate structural members and covered with a heavy steel mesh screening.

A high purity ceramic fiber blanket of sufficient thickness for the maximum operating temperatures is mounted on the interior walls of the cage, forming the actual heating chamber.

The high purity ceramic blanket does not contain any organic constituents, thus posing no threat to the furnace or the work being heat treated.

The ceramic blanket used is a highly efficient thermal insulator, having low thermal conductivity, low heat storage, and is resistant to thermal shock.

07/05/1990 (12)

3.5. Heating Elements

The furnace is heated by horizontally mounted ceramic elements that have been fired from two special ceramic mixtures, such that only that section within the heating chamber will heat to control temperature.

3.6. Water Cooling

Water is circulated to the furnace areas, heat exchangers, and access heads to maintain proper operating temperatures. The flow is controlled by an automatic water controller.

3.7. Control Panel

The control panel is equipped with all of the necessary control instruments and switches, mounted and clearly labeled according to their functions.

3.8. Power Supply

Power to the furnace elements is supplied by a free standing power pack containing the variable output transformers, regulated by a step-less amplifier, controlled by a proportional controller connected to a thermocouple in the heating chamber.

3.9. Power Terminals

Power is brought into the heating chamber through terminal feed-throughs. These terminals are electrically insulated from the chamber and are equipped with vacuum seals.

3.10. Forced Convection Inert Gas Cooling

This system consists of a baffle plug located at the rear of the heating chamber which opens with the heating chamber front doors during the cooling cycle. The gas circulating fan is surrounded by the finned coiled heat exchanger. The inert gas circulates through the heat exchanger, along the water cooled vessel walls through the open front door, the work load and the rear baffle plug.

3.11. Furnace Load and Unload Mechanisms

This consists of two pusher and puller heads attached to captivated chains and drive sprockets. The heads are advanced and retracted by a drive system consisting of a hydraulic motor and a directional valve.

Numerous sensing devices are provided to establish a smooth and consistent operation.