



CARBURIZING & CARBONITRIDING

A TRADITIONAL SURFACE HARDENING TREATMENT WITH MODERN PROCESS CONTROLS

WHAT IS IT?

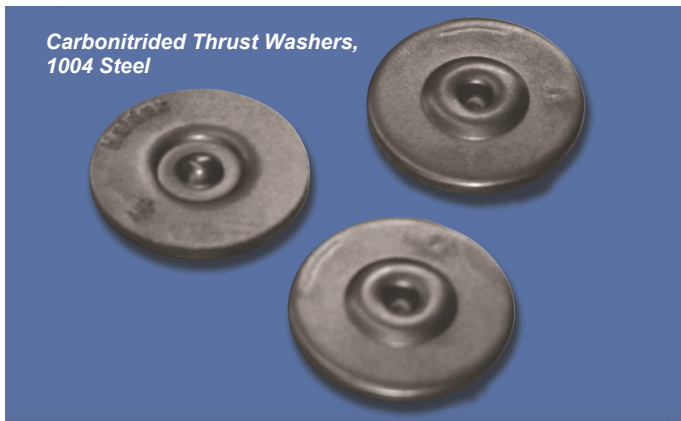
General Description of Carburizing & Carbonitriding

Carburizing is a process of controlled diffusion of carbon into the surface of a component, followed by quenching and tempering, with the objective of increasing the component's surface hardness. The process is generally applicable to low carbon and low alloy steels. There are two carburizing process types available commercially – vacuum carburizing and conventional carburizing. The former is described in a separate brochure, and conventional carburizing is discussed here.

In this thermal process ferrous alloys are heated to above their transformation temperature and exposed to carbon rich atmosphere. Processing temperatures in conventional carburizing typically are in the 1450°F - 1900°F (790°C - 1040°C) range. The diffusion of carbon into the part and the subsequent quench leads to a part with a hard, wear resistant surface and a tough, shock resistant core.

Carbonitriding is a process similar to carburizing except that ammonia is added to the carburizing atmosphere, which produces an effect of supplementary nitrogen diffusion into the component and results in a higher surface hardness.

Note: carbonitriding is sometimes confused with nitrocarburizing. Please read the descriptions of both processes to avoid misunderstandings. Nitrocarburizing is described in a separate brochure.



Carbonitrided Thrust Washers,
1004 Steel

WHY CARBURIZING OR CARBONITRIDING?

Reasons to Use this Type of Process

The reasons to use this process in preference of any other heat treating method are as follows:

- high surface hardness with a tough, durable core,
- case depths up to 0.250" are achievable,
- ability to use inexpensive steels and still produce components with hard surface properties,
- generally used for parts subjected to cyclical loading,
- cost effective for parts where some distortion is acceptable,
- carbonitriding is used for applications where slightly higher surface hardness levels are required.

HOW IS IT DONE?

Equipment & Process

Solid, molten salt and gaseous carbon-carrying medium may be employed, however, the first two are now rarely used. Nitrex offers gas carburizing in computer controlled integral quench and pit gas carburizing furnaces. A full range of case depths is feasible with an economically derived limit of approximately 0.250" (6.4 mm). In addition, Nitrex offers vacuum carburizing which is described in a separate company publication.

The sequence of operations is as follows :

- parts are appropriately fixtured, loaded into the furnace, and the process is initiated
- computers and/or process controllers are programmed to conduct the process automatically,
- at the end of the process the load is either direct quenched (in an integral quench furnace) or soft case and quenched in another furnace, for grain and case refinement,
- subsequently the parts can be tempered, or cryogenically treated (for maximum case properties) and tempered.



Loading a Carburizing Furnace

ALTERNATIVES

What Alternatives May Be Considered and Why

Designers will normally consider one of the following options:

- vacuum carburizing (described in a separate brochure) for better control of properties and distortion,
- nitriding of prehardened materials, generally for more refined applications.
- selective carburizing – utilized when only specific areas of the component need to be hardened.

CARBURIZING & CARBONITRIDING

CAPABILITIES, PROCESS CONTROL & RESULTS

HOW IS IT CONTROLLED?

Characteristics Controlled in Carburizing / Carbonitriding

In our carburizing the following aspects of the process and the results are controlled:

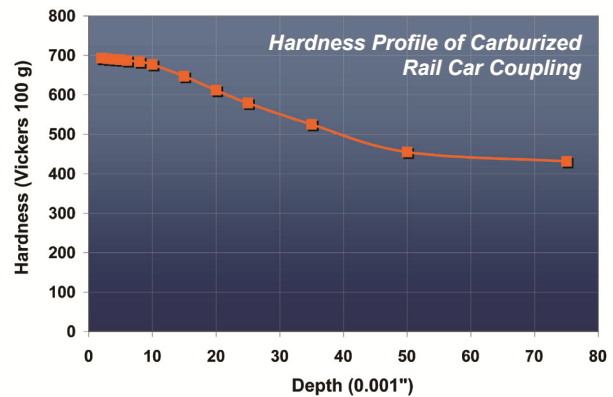
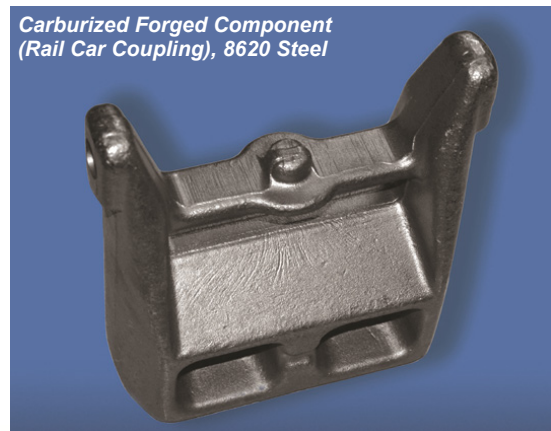
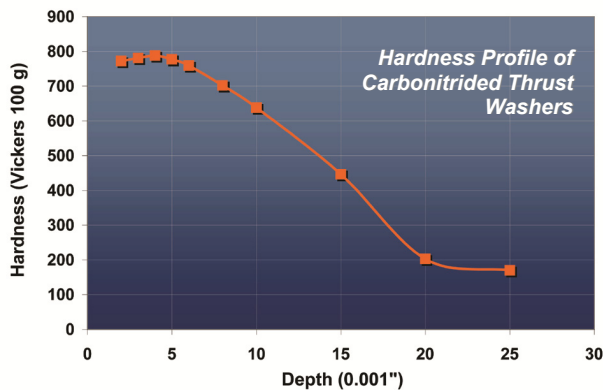
- carbon potential: Nitrex computers control the gas mix in real time throughout the entire process,
- temperature: the same computer controls the temperature which affects the case depth, part distortion and case properties,
- quench medium and its temperature dictates core, part distortion and surface hardness,
- tempering temperature reduces the case hardness to the specification requirement level.

An appropriate gas mix and flow are critical to the process. Our equipment is capable of controlling the relative carbon percent within less than 5% of the desired target.

WHAT CAN BE TREATED?

Materials and Applications Suitable for Carburizing or Carbonitriding

The process is particularly suited to low or medium-carbon steels, and selected alloyed steels. Typical applications include: gears, bearings, ball screws, sleeves, races, rollers, bushings, pinions, shafts, pins, and ball joints.



WHY NITREX?

Reasons for Selecting Nitrex to Be Your Subcontractor

Carburizing and carbonitriding are high temperature processes where process control is critical to ensure the optimal results with minimum distortion. Our processing capabilities, computer controls and the team of engineers with a significant amount of experience with the process, provide you – the customer – with the best possible results tailored to your specific applications. We offer various versions of the carburizing / carbonitriding process: conventional, deep case and vacuum carburizing (described in a separate brochure).

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