



OVERVIEW | STATUS OF 12/2017 | E GAS NITRIDING

Gas nitriding

Dimensions:
ø max. 3000 mm x 4500 mm

Fully automated Process

GAS NITRIDING

Gas nitriding is a standard heat treatment, in which from our side the hardness and distortion of the work pieces cannot be affected.

Usually, there are distortions of no more than to a thousandth degree. The surface hardness that can be achieved depends on the material used or its alloying elements respectively and the microstructure, residual stresses and possible constructive attributes.

In order to achieve a certain lack of distortion and the possible hardness values, it is recommended to prepare the material accordingly.

THE FOLLOWING HEAT TREATMENT SEQUENCE HAS BEEN PROVEN AS BENEFICIAL:

1. Quenching and tempering of the raw semi finished work piece (if firmness required)
2. Intermediate treatment on approx. 1 mm machining allowance (if geometrically required)
3. Stress relief annealing
4. Further treatment to gas nitriding: Special reference is made to work pieces that contain enclosed hollow parts: Hollow parts must be completely dry, free of grease and clean inside.

To achieve the hardening depth, the work pieces are hardened according to our experience. However, a determination of the actually achieved hardening depth is only possible on a sample which consists of identical material and must be heat treated in exactly the same way. If you desire verification of the Nht, please supply respective sample material.



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GAS NITRIDING TABLE**

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| Material group | Designation | Material no. | Surface hardness HV3 | Nitration hardness depth (acc. to DIN 50190 part 3) |
|----------------------------------|----------------|--------------|----------------------|--|
| Construction steels | S355J2G3 | 1.057 | 530-700 | 0,2-0,8 mm |
| Tempering steels | CK 45 | 1.1191 | 300-400 | 0,2-0,7 mm |
| | 25 CrMo 4 | 1.7218 | 550-700 | 0,2-0,7 mm |
| | 35 CrMo 4 | 1.7220 | 550-700 | 0,1-0,6 mm |
| | 42 CrMo 4 | 1.7225 | 550-700 | 0,1-0,6 mm |
| | 50 CrMo 4 | 1.7228 | 550-700 | 0,1-0,5 mm |
| | 51 Cr V 4 | 1.8159 | 600-750 | 0,1-0,6 mm |
| | 34 CrNiMo 6 | 1.6582 | 600-800 | 0,1-0,6 mm |
| | 30 CrNiMo 8 | 1.6580 | 650-800 | 0,1-0,6 mm |
| | 32 CrMo 12 | 1.7361 | 700-900 | 0,1-0,8 mm |
| | 30 CrMo V9 | 1.7707 | 750-850 | 0,1-0,8 mm |
| Nitrided steels | 14 CrMo V 6.9 | 1.7735 | 800-900 | 0,1-1,0 mm |
| | 31 CrMo 12 | 1.8515 | 800-900 | 0,1-0,8 mm |
| | 31 CrMo V9 | 1.8519 | 750-850 | 0,1-0,8 mm |
| | 34 CrAl 6 | 1.8504 | 900-1100 | 0,1-0,8 mm |
| | 34 CrAlMo 5 | 1.8507 | 900-1100 | 0,1-0,8 mm |
| Case-hardened steels | 34 CrAlNi 7 | 1.8550 | 900-1100 | 0,1-0,8 mm |
| | 16 MnCr 5 | 1.7131 | 600-800 | 0,1-1,0 mm |
| Cold-work steels | 20 MnCr 5 | 1.7141 | 600-800 | 0,1-1,0 mm |
| | 100 Cr6 | 1.3505 | 450-600 | 0,1-0,6 mm |
| | X 210Cr12 | 1.2080 | 1000-1200 | 0,1-0,2 mm |
| Hot-work steels | 40 CrMnMo 7 | 1.2311 | 650-800 | 0,1-0,5 mm |
| | 55 NiCrMo V6 | 1.2713 | 550-700 | 0,1-0,5 mm |
| | 55 NiCrMo V7 | 1.2714 | 550-700 | 0,1-0,5 mm |
| | X 37CrMo V5-1 | 1.2343 | 900-1100 | 0,1-0,4 mm |
| Nodular graphit cast iron | X 40 CrMo V5-1 | 1.2344 | 900-1100 | 0,1-0,4 mm |
| | GGG 50 | | 500-700 | 0,1-0,4 mm |
| | GGG 60 | | 550-700 | 0,1-0,4 mm |



**OVERVIEW | STATUS OF 12/2017 | E
GNC-OX-NITRIDING I**

GNC-Ox-nitriding

Dimensions:
ø max. 3000 mm x 4500 mm

Fully automated Process

GNC-OX-NITRIDING

PROCESS

Nitriding or nitrocarburization following the GNC-Ox process is a combination of different thermo-chemical process steps, like gas nitrocarburization, plasma activation and oxidizing. This creates wear resistant and corrosion resistant surface layers. After treatment, the surfaces show a dark grey to black colour.

AIM OF PROCEDURE

- Functional surfaces are optimized by:
- Increased corrosion resistance
- Improved wear resistance
- Improved mechanical-dynamic properties

APPLICATION

Individual components and duplicate parts can be processed. A broad range of material qualities, non-alloy construction steel qualities, case-hardened and tempering steels or even high-alloy tool steels can be treated with GNC-Ox. The GNC-Ox process provides an alternative to salt bath nitriding with oxidation for many components of the automotive and hydraulic industry, mechanical engineering and mining.

DISTORTION AND DIMENSIONAL CHANGE

The GNC-Ox process only has a small impact on distortion and dimensional change of components. The deformation is much smaller compared to carburization or carbonitration respectively. In addition, the deformation can be positively affected by a variation of the process parameters, e.g. temperature. A dimensional change of the components can be observed through formation of the white layer. In case of a previous production, such a dimensional change can already be taken into account.

CORROSION RESISTANCE

The required corrosion resistance of the components is influenced by different factors: Material, roughness, contamination of the surface and component geometry. They have an impact on the corrosion resistance. The achievable results of the heat treatment can be significantly improved beforehand through discussions and agreements between the customer and Stahlhärtereie Haupt. For several materials, the standard requirements of corrosion resistance (> 96h salt spray test DIN 50021 SS) is thus exceeded.



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GNC-OX-NITRIDING II**

GNC-Ox-nitriding

Dimensions:
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Fully automated Process

GNC-OX-NITRIDING

SURFACE HARDNESS AND NITRATION HARDNESS DEPTH

Essentially, the achievable surface hardness depends on the raw material. Higher hardness values allow alloying elements like chromium and aluminium. The nitration hardness depth depends on their specifications. The achievable coating parameters are also affected by the condition of the component at delivery, e.g. degree of distortion and heat treatment condition.

WHITE LAYER AND DIFFUSION ZONE

Through diffusion of primary carbon and nitrogen into the surface, a diffusion zone (DZ) and a white layer (WL) are formed. Subsequently, a compact oxide film, which essentially results in the corrosion resistance, creates oxidation of the components.

The wear behaviour of the component is determined by the WL. The mechanical-dynamic properties of the component are affected by the DZ.

PRE-TREATMENT AND POST-TREATMENT

On delivery, components should be as free as possible from contamination and residues, and be metallically bright. Components are usually finish-machined when they are delivered. It is also possible to carry out further treatment by grinding or polishing to improve the roughness. This should be agreed before carrying out the treatment. Nitriding and nitrocarburisation are increasing in importance due to the multiplicity of possible applications. As well as mechanical, technological properties, the resistance to corrosion is playing an ever more important role in the functionality of stressed surfaces. As well as improving the wear characteristics, the GNCOx process also enables the resistance to corrosion to be significantly improved.



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GNC-OX NITRIDING TABLE**

GNC-Ox nitriding

Dimensions:
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Fully automated Process

| Material | | Strength after tempering (N / mm ²) Tempering temperature 600 ° C | | Guide values for the surface hardness 90 min. 580 ° C GNC-Ox treated | | |
|-------------|-----------------|--|-----------|---|-------|-------|
| Shortname | Material number | 2 hours | 6 hours | HV 1 | HV 10 | HV 30 |
| CK15 | 1.1141 | 600 | 550 | 350 | 300 | 200 |
| C45W3 | 1.1730 | 750-800 | 700-800 | 450 | 350 | 250 |
| Ck60 | 1.1221 | 750-900 | 700-800 | 450 | 350 | 250 |
| 20MnCr5 | 1.7147 | 800-950 | 800-900 | 600 | 450 | 400 |
| 53MnSi4 | 1.5141 | 850-950 | 800-900 | 450 | 400 | 350 |
| 90MnV8 | 1.2842 | 1000-1200 | 900-1100 | 550 | 450 | 400 |
| 42CrMo4 | 1.7225 | 900-1200 | 900-1100 | 650 | 500 | 450 |
| X19NiCrMo4 | 1.2764 | 900-1100 | 900-1000 | 600 | 500 | 450 |
| 55NiCrMoV6 | 1.2713 | 1200-1400 | 1150-1300 | 650 | 550 | 500 |
| 56NiCrMoV7 | 1.2714 | 1300-1500 | 1250-1400 | 650 | 550 | 500 |
| 50NiCr13 | 1.2721 | 1200-1350 | 1100-1200 | 660 | 500 | 450 |
| X20Cr13 | 1.2082 | 1000-1200 | 1000-1200 | >900 | 600 | 450 |
| X35CrMo17 | 1.4122 | 1000-1200 | 1000-1200 | >900 | 700 | 550 |
| X210Cr12 | 1.2080 | 1500-1700 | 1400-1600 | >800 | 600 | 450 |
| X210CrW12 | 1.2436 | 1500-1800 | 1400-1650 | >800 | 600 | 500 |
| X165CrMoV12 | 1.2601 | 1400-1900 | 1400-1700 | >800 | 650 | 500 |
| 45CrMoW58 | 1.2603 | 1500-1800 | 1400-1700 | 800 | 700 | 600 |
| X32CrMoV33 | 1.2365 | 1700-1800 | 1600-1750 | >900 | 850 | 700 |
| X38CrMoV51 | 1.2343 | 1700-1900 | 1500-1700 | >900 | 850 | 700 |
| X37CrMoV51 | 1.2606 | 1700-1900 | 1600-1800 | >900 | 800 | 700 |
| X30WCrV53 | 1.2567 | 1700-1900 | 1600-1800 | >900 | 850 | 750 |
| X30WCrV93 | 1.2581 | 1500-1800 | 1500-1700 | >900 | 850 | 800 |



Nitriding | Tenifer® Q-P-Q

Dimensions:
ø max. 3000 mm x 4500 mm

Fully automated Process

TENIFER® Q-P-Q

As well as improving characteristics such as wear protection, fatigue resistance and sliding properties, TENIFER® treatment with oxidative cooling or post-treatment considerably increases the resistance to corrosion.

Results of investigations and practical applications show that the quality of the treated components is often superior to galvanic coating and other nitrocarburisation processes.

For the TENIFER® process, this opens up a wide field of applications which often require the use of expensive tools.

The process is finding ever greater prevalence in the metalworking industry worldwide. This is due to the process characteristics which include very good reproducibility with high quality, simple handling and high flexibility. The process is distinguished by high environmental compatibility.

TENIFER® - Q - THE PREREQUISITE FOR

- Resistance to wear
- Resistance to corrosion
- Resistance to shrinking
- Resistance to heat
- Resistance to fatigue

TENIFER® - Q + P - FOR ADDITIONAL

- Reduction of surface roughness
- Reduction of the coefficient of friction
- Improvement of the visual appearance of the component

TENIFER® - Q + P + Q - THE FINISH FOR

- Maximum resistance to corrosion
- Decorative black surface
- Minimum light reflection
- Best visual appearance

Following the hardness comparison table, we have attached comprehensive information on Tenifer which has been prepared by Durferrit GmbH.