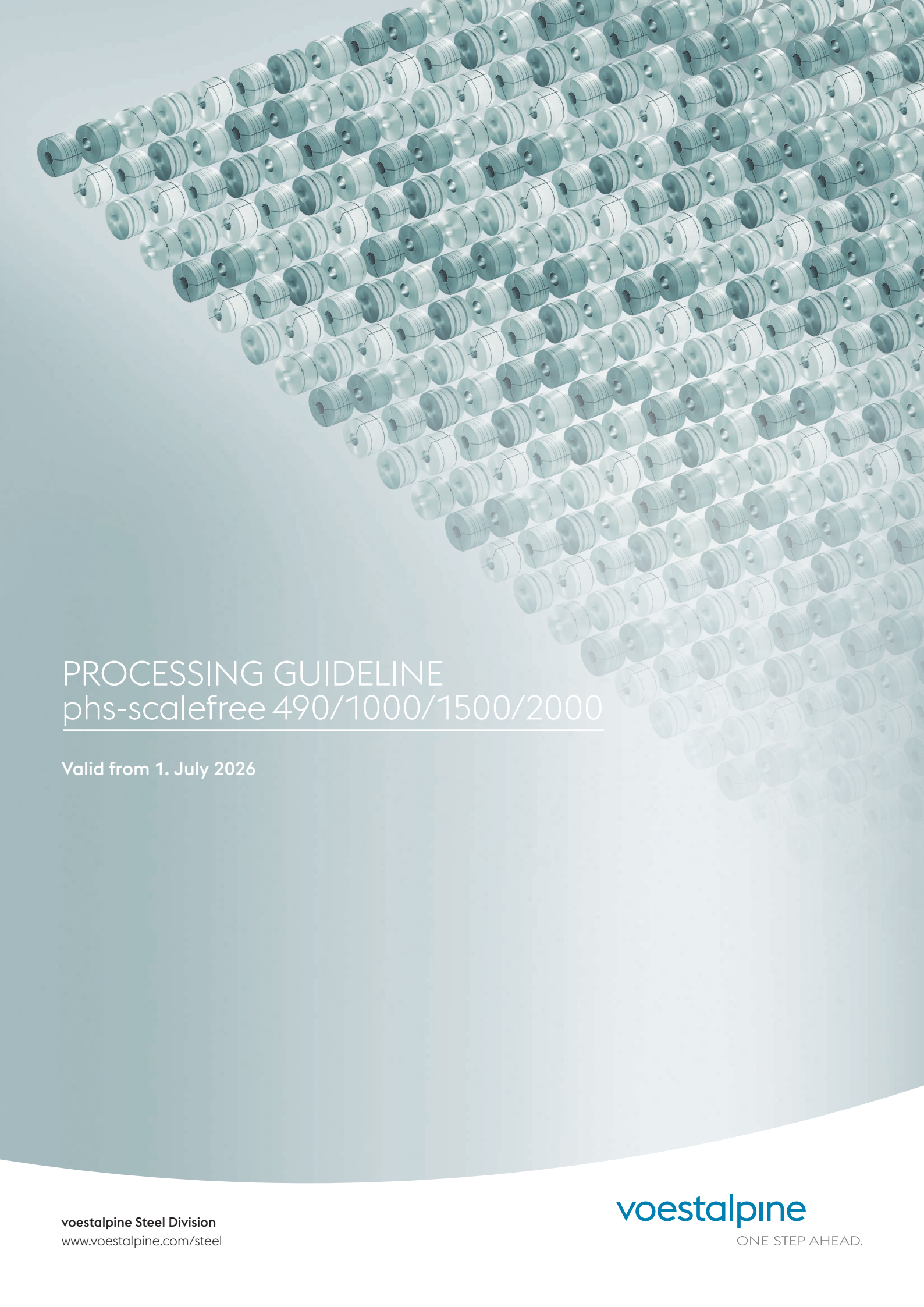




PROCESSING GUIDELINE

phs-scalefree 490/1000/1500/2000

Valid from 1. July 2026

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GENERAL INFORMATION

TRANSPORT, STORAGE AND HANDLING

Substances that must not come into contact with the blank surface include, among others:

- » Deicing salt
- » Ambient dust
- » Iron dust (from abrasive cutting etc.)
- » Water-based forming lubricants
- » Acids and alkalis
- » Phosphorus-containing substances (oiling)
- » Phosphorus- and fluorine-containing substances (pretreatments, passivations etc.)

To prevent the formation of white rust, care must be taken during the storage of coils and blanks to prevent the ingress of any form of moisture (condensation due to dropping below the dew point, splashing water etc.).

To prevent contamination, clean gloves must be worn when handling blanks.

To prevent local burning of the zinc layer in the PHS furnace due to PVC abrasion on the blanks, PVC conveyor belts or rollers must be avoided.

LIST OF RECOMMENDED OILS AND FORMING LUBRICANTS

- » Anticorrit PL3802 (Fuchs)
- » Anticorrit RP4107 (Fuchs)
- » Multidraw PL 61 prelube (Zeller+Gmelin)
- » Multidraw PL 61 SE (Zeller+Gmelin) = prelube2
- » Multidraw KTL N16 (Zeller+Gmelin)

PRESS HARDENING

The target windows for the mechanical properties of phs-scalefree 490, phs-scalefree 1000, phs-scalefree 1500 and phs-scalefree 2000 after press hardening are shown in Table 1.

Table 1: **Mechanical properties for phs-scalefree®**

	phs-scalefree 490	phs-scalefree 1000	phs-scalefree 1500	phs-scalefree 2000
Yield strength $R_{p0.2}$	350 - 460 MPa	750 - 1,000 MPa	950 - 1,250 MPa	1,100 - 1,450 MPa
Tensile strength R_m	460 - 610 MPa	950 - 1,250 MPa	1300 - 1,650 MPa	1,750 - 2,150 MPa
Elongation at break A_{50}	$\geq 12 \%$	$\geq 5.5 \%$	$\geq 4 \%$	$\geq 4 \%$

The mechanical properties specified in Table 1 can be achieved using the parameters for the press hardening process specified in Table 2.

Table 2: **Process parameters for phs-scalefree®**

	phs-scalefree 490	phs-scalefree 1000	phs-scalefree 1500	phs-scalefree 2000
Press hardening furnace temperature	860 - 920 °C	860 - 920 °C	860 - 920 °C	860 - 920 °C
Achieved sheet temperature	840 - 910 °C	855 - 910 °C	855 - 910 °C	855 - 910 °C
Transfer temperature	680 - 780 °C	700 - 800 °C	700 - 800 °C	700 - 800 °C
Press pressure	1 - 40 MPa	1 - 40 MPa	1 - 40 MPa	1 - 40 MPa
Max. furnace dwell time above 840 °C achieved sheet temperature	200 s	200 s	200 s	200 s

Additional information on the press hardening process:

- » To prevent evaporation of the zinc layer and to achieve a favorable oxide formation regarding welding and phosphating suitability, austenitization must be carried out in an air atmosphere, ensuring sufficient air circulation.
- » If the surface properties present after press hardening do not meet the requirements for joining technology and painting (paint adhesion, appearance, corrosion performance), post-conditioning is recommended, e.g. by the following:
 - » Wheel blasting (proven process)
 - » Dry ice blasting
 - » Vibratory finishing
- » To achieve the elongation at break specified in Table 1 for phs-scalefree 490, a uniform local cooling rate must be ensured.

The test facility used for this purpose by voestalpine Stahl GmbH to determine these process parameters is shown in Figure 1. The press holding times are listed in Table 3 as a function of the sheet thickness.

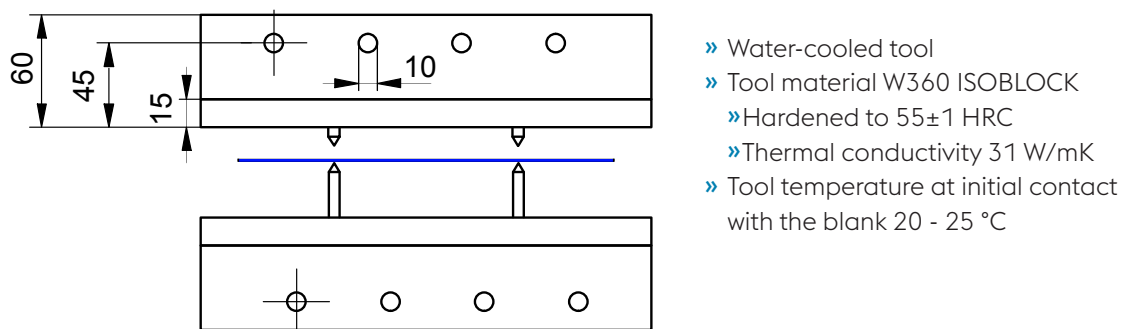


Figure 1: Test facility for press hardening flat blanks at voestalpine Stahl GmbH

Table 3: Press holding times t_{zu} as a function of the considered sheet thickness d

Parameter	Value							
d (mm)	1	1.2	1.4	1.6	1.8	2.0	2.2	2.4
t_{zu} (s)	4.0	4.7	5.5	6.4	7.4	8.4	9.6	10.8

LEGAL STATUS OF THE PROCESSING GUIDELINE

All information in the processing guideline regarding the condition, properties, suitability, or usability of the delivered goods serves exclusively as a general product description based on the technical state of knowledge available at the time of creation. It does not constitute a quality agreement or contractual specification within the meaning of the law.

No specific warranty commitments, guarantees, guaranteed values, or other assurances regarding the presence of certain properties or suitability for a specific intended purpose or for specific manufacturing processes can be derived from the processing guideline alone. Such commitments always require a separate, express written agreement signed by authorized signatories of voestalpine.

Prior to starting processing, the processor is obliged to verify on its own responsibility whether the delivered material is suitable for the specific intended purpose. The processing guideline does not exempt the processor from this duty of inspection.

LEGAL CONSEQUENCES OF NON-COMPLIANCE WITH THE PROCESSING GUIDELINE

If the processing guideline is not observed by the processor, warranty and damage claims against the supplier are excluded for any defects or damage that can be proven to result from non-compliance with the processing guideline.

This applies in particular, but not exclusively, to the following:

- » Material failure, cracking, or deformation due to impermissible processing parameters;
- » Corrosion damage due to impermissible heat treatment or damage to protective coatings;
- » Damage to subsequent products manufactured from raw material that was not treated in accordance with processing specifications.

Any legal disputes resulting therefrom shall be governed exclusively by the General Terms and Conditions of Sale for Deliveries and Services of the voestalpine Steel Division, as of 04/2019, in particular section 14. Place of Jurisdiction, Choice of Law, Place of Performance.

