



Sanding of wooden floors

The manual

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CONTENT

1	Introduction	4
1.1	General information	4
1.2	Premium Sanding Technology PST®	4
2	Preparations before the laying of wooden floors	5
2.1	Subfloor preparation	5
2.1.1	Subfloor preparation for glued wood flooring	5
2.1.2	Subfloor preparation for nailed wood flooring	6
2.2	Subfloor treatment using the TRIO	7
2.3	Subfloor treatment using the SINGLE	8
2.3.1	Milling disk for the SINGLE	9
2.3.2	Additional weight for the SINGLE.....	9
3	Preparation of wooden floors for sanding.....	10
3.1	Before sanding	10
3.2	Filling Joints	10
3.3	Practical assistance	10
4	Important facts about abrasives	11
4.1	Abrasive composition	11
4.1.1	Abrasive grit	11
4.1.2	Cover and base bonds	11
4.1.3	Underlayment	11
4.2	Cutting materials	12
4.3	Dispersion and abrasive quality	13
5	Grit and grit sequence.....	14
5.1	Grit.....	14
5.2	Correct choice of the grit sequence	15
5.3	Example of various grit sequences	16
6	Application of the machines.....	18
6.1	Different ways of sanding.....	18
6.1.1	Conventional method	18
6.1.2	Method in accordance to the Premium Sanding Technology PST®	18
6.2	Time savings due to lower expenditure for edge sanding	19
6.3	Time expenditure and physical strain	19
7	Important points when working with the HUMMEL® belt sanding machine	20
7.1	Method of operation.....	20
7.2	Sanding path displacement.....	21
7.3	Sanding pressure setting.....	22
7.4	Walking speed	22
8	Sanding directions using the HUMMEL® belt sanding machine	23
8.1	Types of parquet and laying patterns with the same sanding direction.....	23
8.2	Strip flooring and floorboards	23
8.2.1	Sanding directions for strip flooring and non-cupped floor boards	23
8.2.2	Special case: cupped floor boards	24
8.2.3	Special case: Vibrating floors.....	24

9	Sanding using the HUMMEL® belt sanding machine	25
9.1	Preparation	25
9.1.1	Checking the flatness of the wood flooring	25
9.1.2	Performing a test sanding operation	25
9.2	Sanding method.....	26
9.3	HUMMEL® processing plan for conventional methods.....	27
9.4	HUMMEL® processing plan for the PST® method	28
10	Sanding using the FLIP® edge and corner sanding machine	29
10.1	Sanding pressure	29
10.2	Sanding method	30
10.3	FLIP® processing plan	31
10.4	FLIP® corner attachment	32
11	Sanding using the TRIO three-disk sanding machine or the SINGLE single-disk sanding machine	33
11.1	Fine sanding using the TRIO.....	33
11.1.1	Sanding method	33
11.1.2	Hints for fine sanding using the TRIO	34
11.1.3	TRIO processing plan for the PST® method	35
11.2	Fine sanding using the SINGLE.....	36
12	Sanding using other LÄGLER® machines	38
12.1	Floor sanding machines.....	38
12.2	Edge sanding machines.....	38
13	Removal of cracks and joints	39
14	Final sanding step.....	40
15	Finishing of wooden floors	41
15.1	Instructions for Finishing.....	41
15.2	Finishing method.....	42
15.3	Intermediate Finish sanding using the TRIO or the SINGLE	43
16	Oiling and waxing of wooden floors	44
17	Caring for wooden floors	45
18	Prevention of sanding marks.....	46
18.1	General information	46
18.2	Drum and belt sanding machines	46
18.3	Edge sanding machines.....	47
18.4	TRIO three-disk sanding machine	47
19	Visible sanding marks after surface treatment.....	48
19.1	On finished surfaces	48
19.2	On oiled surfaces.....	48
20	Hazard warnings	49

Introduction

1.1 GENERAL INFORMATION

Wood floors provide an ideal indoor room climate and have an outstanding appearance. Wood as a regenerative resource with its good CO₂ balance offers many additional advantages.

Solid wood floors in particular cause little stress to the environment since their production requires less energy and adhesives than such alternatives as engineered floors. Together with their long durability, they are therefore rated as particularly sustainable. Therefore the environmental pollution caused by wood floors is significantly less than that of any other floor covering.

Sanding is particularly important for creating a high quality wooden floor.

LÄGLER® has prepared this manual to provide craftspeople with a useful aid which offers valuable hints for the correct handling of floor sanding machines. It shows the most popular methods by using the latest technology.

NOTE:

It is advisable, however, to adapt the methods to your individual needs!

IMPORTANT:

Please read *Section 18, Prevention of sanding marks* to achieve a good final result!

1.2 PREMIUM SANDING TECHNOLOGY PST®

LÄGLER® has developed the **Premium Sanding Technology PST®** to achieve premium surfaces on wood flooring. **PST®** is the optimal combination of LÄGLER® machines, LÄGLER® abrasives and an adaptable concept.

PST® method:

- Appraisal of the site
- Determination of the surface treatment
- Adaptation of the usage concept to the wood flooring properties (Determination of the machines and the grit sequences)

Example:

Newly laid wooden floors with very little over wood and under wood can be initially sanded with the TRIO three-disk sanding machine, making it unnecessary in this case to use the HUMMEL® belt sanding machine.

Companies and their employees can participate in training sessions at LÄGLER® in Güglingen-Frauenzimmern to learn more about **PST®** and convince themselves of the high efficiency and quality of the overall concept.

More information is available on our homepage:
www.laegler.com

For more information please contact:

- our Sales Service, Telephone **0049 - 7135 - 98 90-0**
- by E-Mail to **info@laegler.com**

Eugen Lägler GmbH assumes no liability for resulting damage!

Preparations before the laying of wooden floors

2.1 SUBFLOOR PREPARATION

The room climate and composition of the subfloor must meet certain requirements. The subfloor must be permanently dry, solid, flat and free of cracks, contamination and substances which impede adhesion.

NOTE:

A carefully prepared subfloor simplifies the laying and sanding of the wood floor.

2.1.1 SUBFLOOR PREPARATION FOR GLUED WOOD FLOORING

Depending on the composition of the subfloor onto which the wood floor is to be glued, the following tests must be performed before laying the floor according to the specified requirements:

- Moisture of the screed:

The most popular method is to perform the moisture measurement using a MMS device. The maximum permissible moisture content is for:

- Cement screed	2.0 %
- Cement screed for underfloor heating	1.8 %
- Anhydride screed	0.5 %
- Anhydride screed for underfloor heating	0.3 %

NWFA recognizes Moisture Vapor Emissions Rate (MVER) "Calcium Chloride Testing" (ASTM F1869) readings not to exceed 3 lbs. or "Relative Humidity Testing" (ASTM F2170) readings not to exceed 75%.

- Stability of the screed:

The screed must be renovated if the stability is not adequate for adhesive bonding.

- Flatness of the subfloor:

The required flatness can be achieved by sanding the subfloor or by using levelling compounds.

NWFA recommends 3/16" in 10 feet or 1/8" in 6 feet for flatness.

- Temperature of the subfloor:

A balanced room climate should generally be prevailed, in which the subfloor temperature does not deviate too strongly from the air temperature. Please observe the manufacturer's temperature specifications for the primer, adhesive and floor covering.

The following points also have to be considered:

- In the case of screeds with sinter layers, this layer has to be removed by sanding with the TRIO (Fig. 1) or the SINGLE (Fig. 2). This makes it possible to achieve a good bond between the wood, adhesive and screed.
- It is advantageous to pre-treat heavily absorbent subfloors with a primer to achieve good adhesion of the wood.
- The wood must be acclimated on site where it is to be laid for as long as necessary to reach proper moisture content (**Note the manufacturer's specifications!**). Always use a moisture meter.

PREPARATIONS BEFORE THE LAYING OF WOODEN FLOORS

2.1.2 SUBFLOOR PREPARATION FOR NAILED WOOD FLOORING

The following points have to be considered before laying if the wood flooring is to be nailed or screwed to the subfloor.

- The subfloor structure has to have the required flatness. The use of a levelling laser for aligning the flooring sleepers is recommended. NWFA recommends 1/4" in 10 feet or 3/16" in 6 feet for flatness.
- The flooring sleepers have to be suitably spaced. The thinner the floorboards or false floor planks / chipboards, the smaller the clearance required between the individual flooring sleepers.
NWFA standards are:
 - 16" joist span requires 5/8" CDX plywood or 3/4" OSB
 - 16" – 19.2" joist span requires 3/4" CDX plywood or 3/4" OSB
 - 19.2" – 24" joist span requires 7/8" CDX plywood or 1" OSB
- In the case of structures with false floors (false floor planks, chipboards), they should be screwed and not nailed onto the false floors due to the stronger connection. Flooring strips, however, can then be screwed or nailed onto the subfloor.

- False floor planks and flooring sleepers often have a comparably high wood moisture content. In order to avoid resulting problems, the false floor planks and flooring sleepers should have the same wood moisture content as the wood flooring to be laid on them.
- Flooring sleeper structures tend to become noisy. For this reason, the noise insulation regulations should be complied with in this regard.
- Flooring sleeper structures must be preventively treated against insect infestation. The regulations in accordance to wood protection have to be observed.

Please see the "Parquet layer's reference book" and the installation guidelines for wood flooring on the NWFA homepage (www.nwfa.org) for **additional information**.

2.2 SUBFLOOR TREATMENT USING THE TRIO

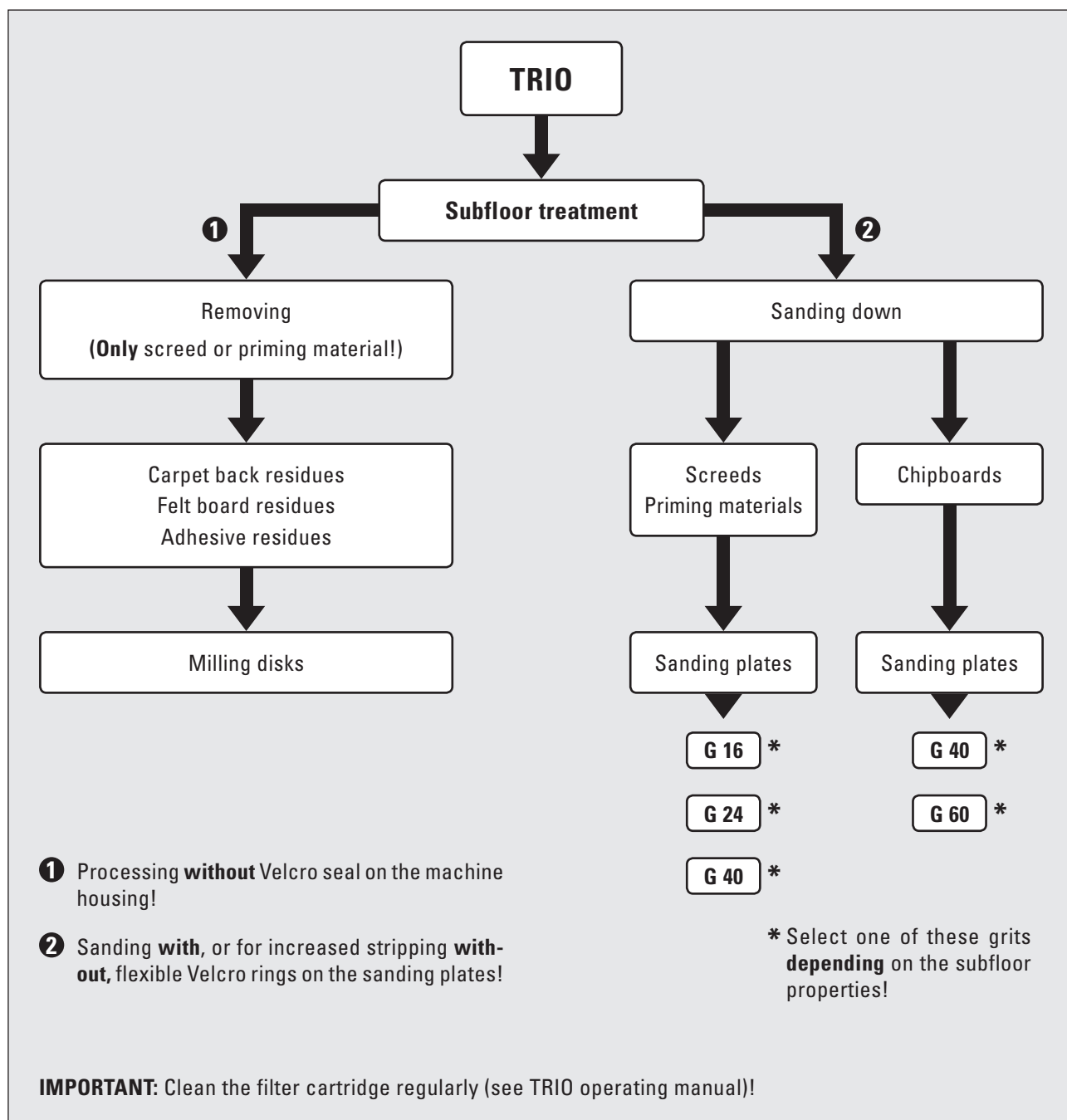


Fig. 1 Processing plan of the **TRIO** three-disk sanding machine for subfloor treatment.

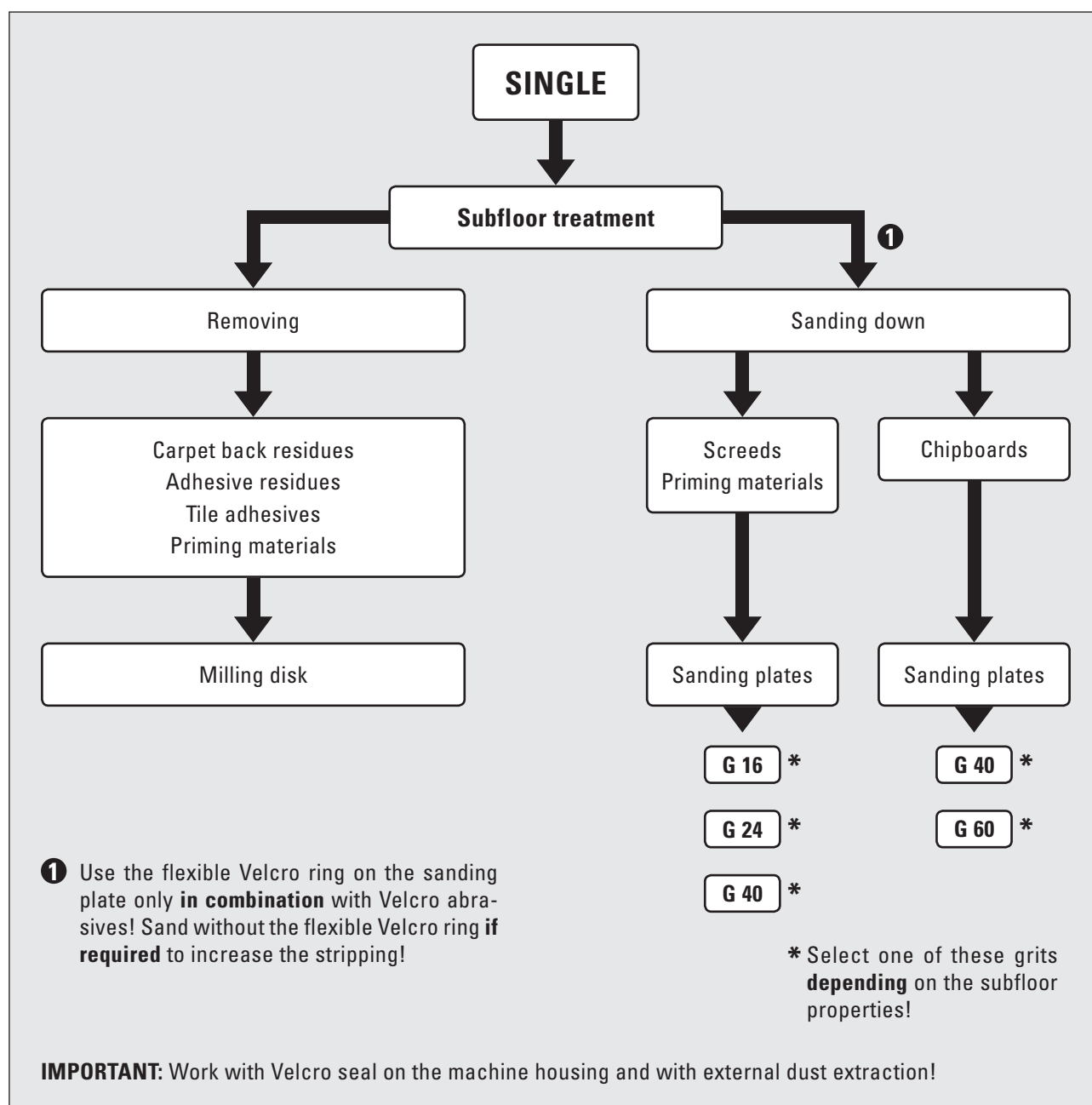
MILLING DISKS FOR THE TRIO

The milling disks available for the TRIO are equipped with hard metal indexable inserts.

This makes it possible to quickly and easily remove carpet back residues, felt board residues and adhesive residues from the subfloor.

The milling disks can be adapted to the floor covering intended for removal and to the condition of the subfloor by increasing or reducing the number of indexable inserts. A reduction increases the aggressiveness of the milling disks.

2.3 SUBFLOOR TREATMENT USING THE SINGLE

Fig. 2 Processing plan of the **SINGLE** single-disk sanding machine for subfloor treatment.

PREPARATIONS BEFORE THE LAYING OF WOODEN FLOORS

2.3.1 MILLING DISK FOR THE SINGLE

The stainless steel milling disk available for the SINGLE is equipped with indexable ceramic inserts.

This makes it possible to quickly and easily remove carpet back residues, adhesive residues, tile adhesives and priming materials from the subfloor.

The milling disk can be adapted to the floor covering intended for removal and to the condition of the subfloor by increasing or reducing the number of indexable ceramic inserts. A reduction increases the aggressiveness of the milling disk.

2.3.2 ADDITIONAL WEIGHT FOR THE SINGLE

The pressure on the milling disk or the sanding plate can be increased by up to 44 lbs. (20 kg) by filling the available additional weight with water.

The usage of the additional weight is particularly suitable for removing difficult residues.

Preparation of wooden floors for sanding

3.1 BEFORE SANDING

To achieve a good sanding result, please observe the following points **before starting to sand**:

- Loose woods or elements must be nailed / glued again.
- Wood elements with visible nicks or splintering must be replaced.
- The wood flooring and expansion gaps must be thoroughly vacuumed directly before sanding.

- The nail or screw heads on nailed or screwed wood floors have to be countersunk deeply enough into the floor that they cannot be sanded.

- Countersink nails, for example, with a hammer and drift punch!
- Retighten the screws!

This prevents parts of the machine (such as abrasives, sanding drum, sanding plates) from becoming damaged (**Prevention of fire hazard**; see *Section 20, Hazard warnings*)!

3.2 FILLING JOINTS

Various methods can be used when joints exist between the individual pieces of wood or elements:

- If the width is less than ~ 1/32" (1 mm), the joints or cracks can be closed by levelling with filler (see *Section 13, Removal of cracks and joints*).

- Joints or cracks wider than ~ 1/32" (1 mm) can no longer be permanently closed with filler. The joints or cracks can then be closed by fitting wood slats or by purging with a **silicone-free joint sealant** available in various colors. Silicone prevents the bonding of the wood flooring with the finish, oil or wax.

3.3 PRACTICAL ASSISTANCE

- To achieve an optimal final result, the moldings should be removed before processing the edge areas. This prevents damage to the moldings and also prevents the sanding of a visible section on the floor in front of the moldings.

In the USA, contractors are required to follow EPA regulations on Lead-based paint prior to disturbing existing baseboards.

- It is recommended to carry out the painting and wall-papering work **before sanding** the wood flooring to prevent damage to the finished surface.

- The HUMMEL® belt sanding machine, the ELF drum sander or the IGEL milling drum can be used very effectively to remove very heavy old coatings (paint, oil, wax or finish) from floorboards.
- In the case of thinner old coatings (paint, oil, wax or finish) premature clogging of the abrasive can be avoided by reverse sanding with the HUMMEL®, SUPERHUMMEL or ELF in the first processing step.

Important facts about abrasives

4.1 ABRASIVE COMPOSITION

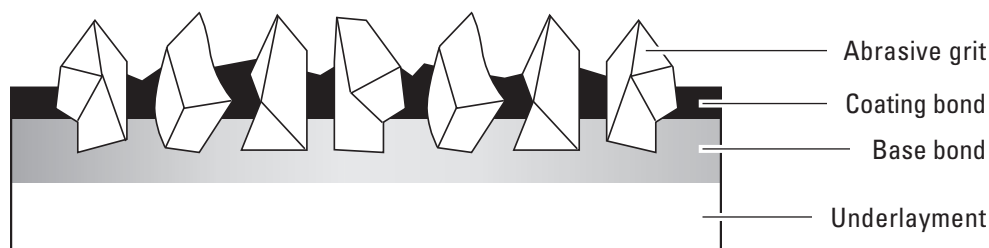


Fig. 3 Structure of an abrasive.

4.1.1 ABRASIVE GRIT

A mixture of abrasive grits comprised of various cutting materials is typically used for an abrasive.

The LÄGLER® zirconia abrasive is ideally adapted for wood sanding and consists of:

- 60 % zirconia abrasive grits
- 40 % aluminum oxide abrasive grits (corundum)

4.1.2 COVER AND BASE BONDS

Synthetic bindings are primarily used today. These bindings have the following advantages:

- very good adhesion to abrasive grit and underlayment
- high temperature stability
- high abrasion resistance
- high climate resistance

The following applies for this:

- The **coating bond** connects and stabilizes the abrasive grits with each other.
- The **base bond** anchors the abrasive grit on the underlayment.

4.1.3 UNDERLAYMENT

The underlayment serves as the base for the abrasive grits and for the bonds. The following underlayments exist:

- Paper underlayment, e.g. A paper, D paper, G paper
- Cloth underlayments such as J-fabric (light cotton), X-fabric (heavy cotton), Z-fabric (heavy polyester)

IMPORTANT:

The type of underlayment depends on the intended usage of the abrasive.

**GOOD MATCHING OF THE ABRASIVE GRIT, BOND AND UNDERLAYMENT
IS PARTICULARLY IMPORTANT FOR A HIGH-QUALITY ABRASIVE!**

4.2 CUTTING MATERIALS

Silicon carbide	Ceramic	Aluminium oxide (corundum)	Zirconia
Grit shape: angular, very sharp-edged	Grit shape: conchoidal fracture, sharp-edged	Grit shape: cubic, less sharp-edged	Grit shape: sharp-edged
Grit hardness: Mohs hardness approx. 9.5 (very hard)	Grit hardness: Mohs hardness approx. 9.2 (very hard)	Grit hardness: Mohs hardness approx. 9.0 (very hard)	Grit hardness: Mohs hardness approx. 8.2 (hard)
Melting point: approx. 4170 °F (2300 °C)	Melting point: approx. 4170 °F (2300 °C)	Melting point: approx. 3630 °F (2000 °C)	Melting point: approx. 5430 °F (3000 °C)
brittle	viscous	viscous	highly viscous
very good initial cutting properties, low service life	good cutting properties at high contact pressure, very long service life	good even cutting proper- ties, high service life	good cutting properties even at low contact pres- sure, very long service life, high bending and breakage resistance
Application: Subfloor treatment Wood sanding Intermediate finish sanding	Application: Steel grinding, hard surfaces (e.g. hard lacquer coatings)	Application: Wood sanding, Intermediate finish sanding	Application: Very effective for wood sanding

Fig. 4 The most common cutting materials.

Advantages of ceramic and zirconia abrasives compared to silicon carbide or aluminum oxide abrasives:

- Higher sanding rates
- Longer service life, thus lower consumption and less frequent changing of the abrasives
- Smaller inventories and space requirements

Zirconia abrasive is more expensive than silicon carbide and aluminum oxide abrasives but due to its advantages stated above, the costs per sanded square meter are lower.

Although **ceramic abrasive** has the same advantages as zirconia abrasive, its usage is not efficient for wood sanding due to its significantly higher price.

4.3 DISPERSION AND ABRASIVE QUALITY

The **abrasive dispersion** affects the cutting behavior and the sanding pattern. A differentiation is made between dense and open dispersion. 100 % of the underlayment is covered by abrasive grit with dense dispersion and 50 – 70 % with open dispersion.

Differences in quality can be noticed at sanding belts and abrasive sleeves in the area of the joint. The best results for the sanding pattern and durability of the abrasive are achieved by a butt joint backed with a special tape.

There are also different joints either in a straight design or in what is referred to as a “sinusoidal line” design (wave shape), where the sinusoidal line has advantages for the durability of the joint and in the sanding pattern.

High quality sanding belts or abrasive sleeves can be recognized by the following features:

- Butt joint.
- Sinusoidal line design of the fastener.
- No significant thickness differences at the joint.
- The cut has to be precise. Cloth of the fabric underlayment which stick out or are not cleanly cut off have a negative effect on the sanding pattern.
- The underlayment is decisive for the quality of the abrasive. It has to match to the respective cutting material and the grit size:
Highly flexible underlayment doesn't offer sufficient hold for rough grains and the abrasive grits break off too quickly.
- A temperature of approx. 64 °F – 72 °F (18 °C – 22 °C) at a humidity of approx. 45 – 65 % is recommended for storage and long durability of the abrasive.

Abrasives with a zirconia content of 60 % are the most effective for sanding wood floors.

Grit and grit sequence

5.1 GRIT

The grit number of an abrasive provides information about the size of the abrasive grit. The individual grit numbers are determined by sifting with various mesh sizes.

The grit number corresponds to the number of meshes per inch of the sieve used for extraction. Therefore, a grit 40 just passes through a sieve with 40 meshes per inch (1" = 25.4 mm).

The smaller the grit number, the fewer meshes the sieve has per inch. The meshes and thus the abrasive grits are correspondingly larger. Larger abrasive grits in return cause deeper and wider sanding marks.

Abrasives with smaller grit numbers are therefore used for higher stripping and abrasives with larger grit numbers for fine sanding.

Since smaller fragments occur more frequently than larger ones, coarse abrasives are generally more expensive than fine ones.

**COARSE ABRASIVE IS MORE EXPENSIVE
THAN FINE ABRASIVE!**

Fig. 5 contains all of the grits available for the major LÄGLER® floor sanding machines.

Since the difference in stripping between grit 36 and grit 40 is barely noticeable, the two grits can be considered nearly identical. For this reason, LÄGLER® does not offer any sanding disks with grit 36 for the FLIP®, ELAN, TRIO and SINGLE.

HUMMEL® Sanding belt	16	24	36	40	50	60	80	100	120			
FLIP® / ELAN Sanding disk	16	24		40		60	80	100	120	150		
TRIO Sanding disk	16	24		40		60	80	100	120	150	180	
TRIO Sanding screen						60	80	100	120	150	180	220
SINGLE Sanding disk	16	24		40		60	80	100	120			
SINGLE Sanding screen						60	80	100	120	150	180	220

16

Aluminum oxide or corundum (Sanding belt)

36

Zirconia (Sanding belt, sanding disk)

16

Silicon carbide (Sanding disk)

60

Silicon carbide (Sanding screen)

Fig. 5 Available grits and materials for the major LÄGLER® floor sanding machines.

5.2 CORRECT CHOICE OF THE GRIT SEQUENCE

The grit sequence is particularly important for an optimal sanding result. The sequence of the abrasive grits used is referred to as the grit sequence.

The grit sequence and the number of sanding operations depend on the size and number of protrusions between the individual wood elements, from the degree of soiling, and from the unevenness of the wood flooring.

- Pre-sanding

It is not necessary to sand with every possible grit (Fig. 5) when pre-sanding with the HUMMEL®. No more than one grit number should be skipped, because otherwise the sanding marks of the previous grit number cannot adequately be removed or only be removed with a great deal of time expenditure and high material consumption.

The first sanding step should be carried out with the finest grit possible to keep sanding marks as minimal as possible.

A sanding step can possibly be eliminated in this way, thus improving the quality and reducing the time expenditure and the material consumption.

- Fine sanding

It is not recommended to skip any grit numbers when fine sanding, using the TRIO.

Since the fine grits remove very little material, the sanding marks of the previous sanding step should not be too coarse. The previous sanding step has then to be repeated to remove excessively coarse sanding marks.

- Particularities

Less material is removed when sanding **hard woods** instead of soft woods. Therefore increased effort is required to remove deep sanding marks. It can therefore be effective in the case of hard wood species such as some tropical wood species to select finer grits than those used for soft woods from the very beginning. One or more cross sanding steps should be carried out for effective work.

5.3 EXAMPLE OF VARIOUS GRIT SEQUENCES

Unevenness, soiling and old finish, oil and wax layers are removed by using coarse grits.

The subsequent sanding steps with the fine grits are simply used to remove the sanding marks of the coarse grits.

As shown in Fig. 6 to Fig. 9, compliance with the grit sequence is particularly important.

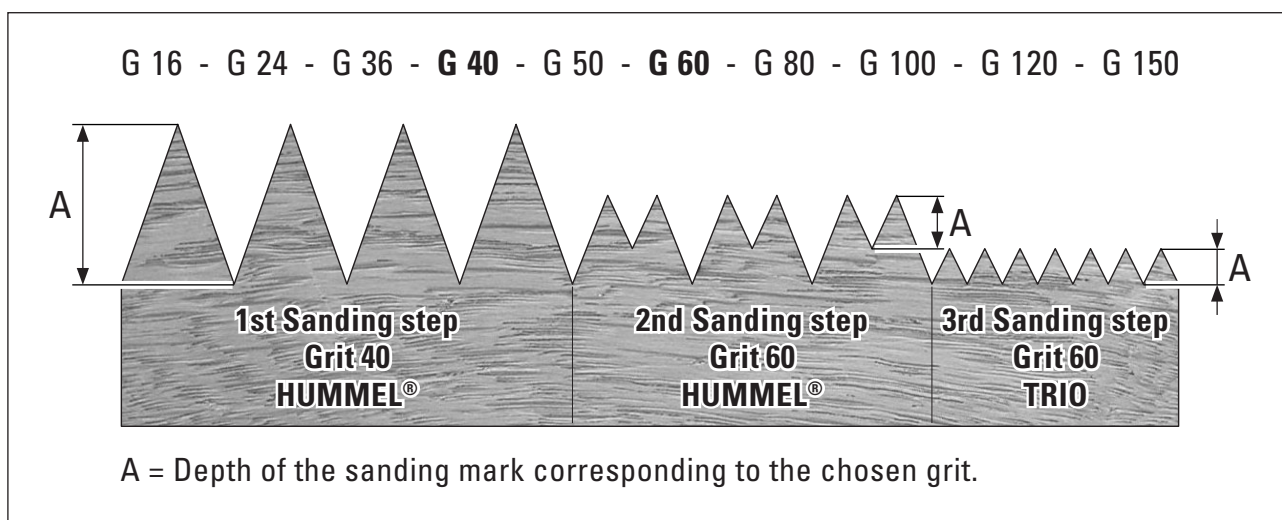


Fig. 6 Correct grit sequence of the sanding steps following grit 40.

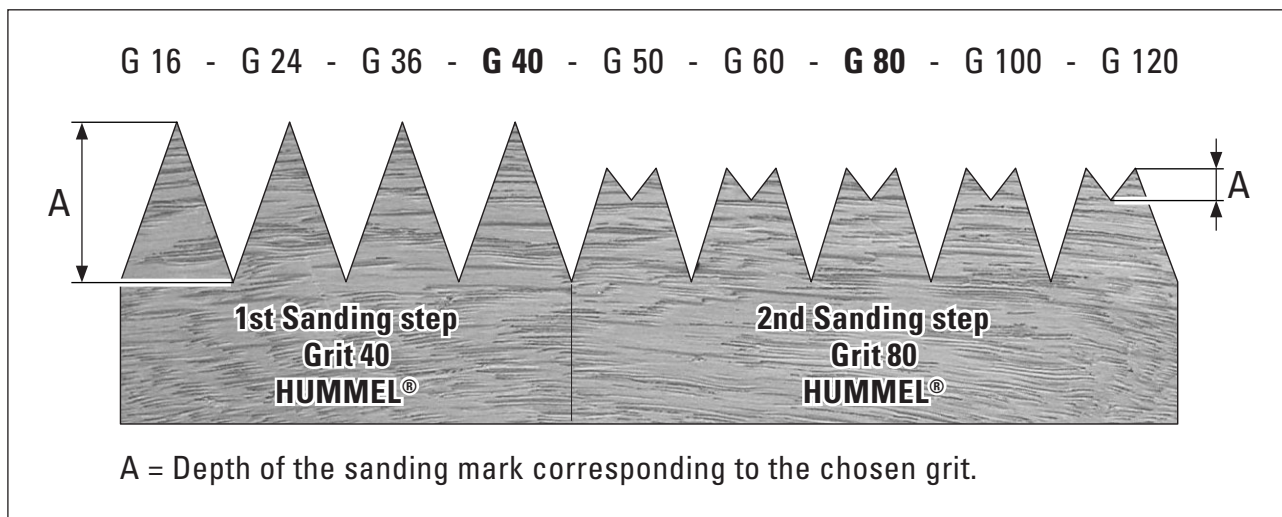


Fig. 7 Incorrect grit sequence: Jumping more than one grit, a lot of time has to be expended and large amounts of material consumed to remove the coarser sanding marks.

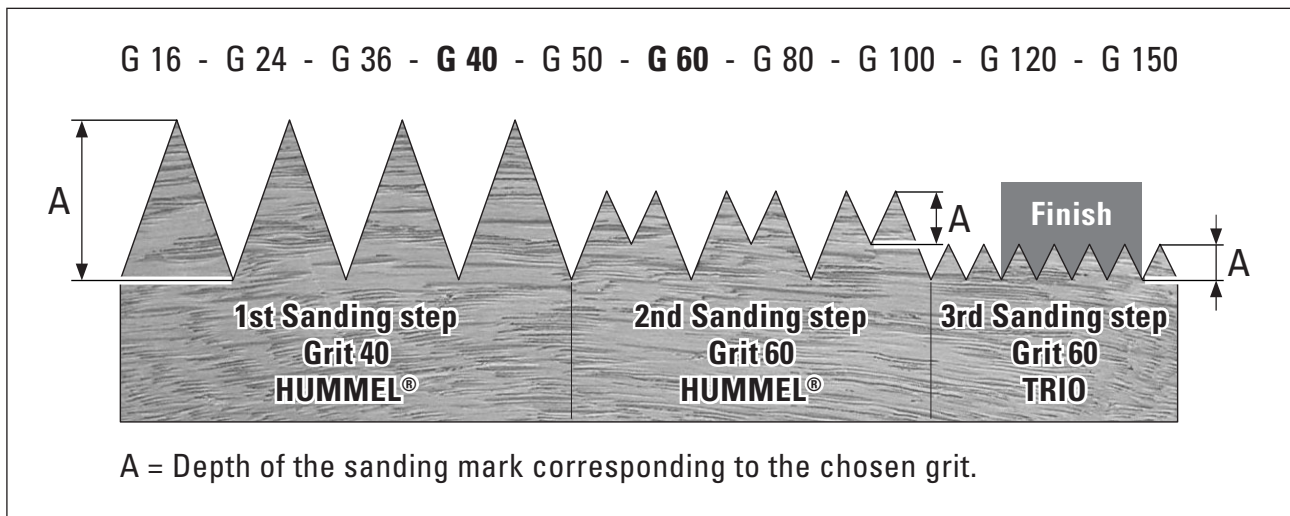


Fig. 8 Finished surface with **correctly** selected grit sequence.

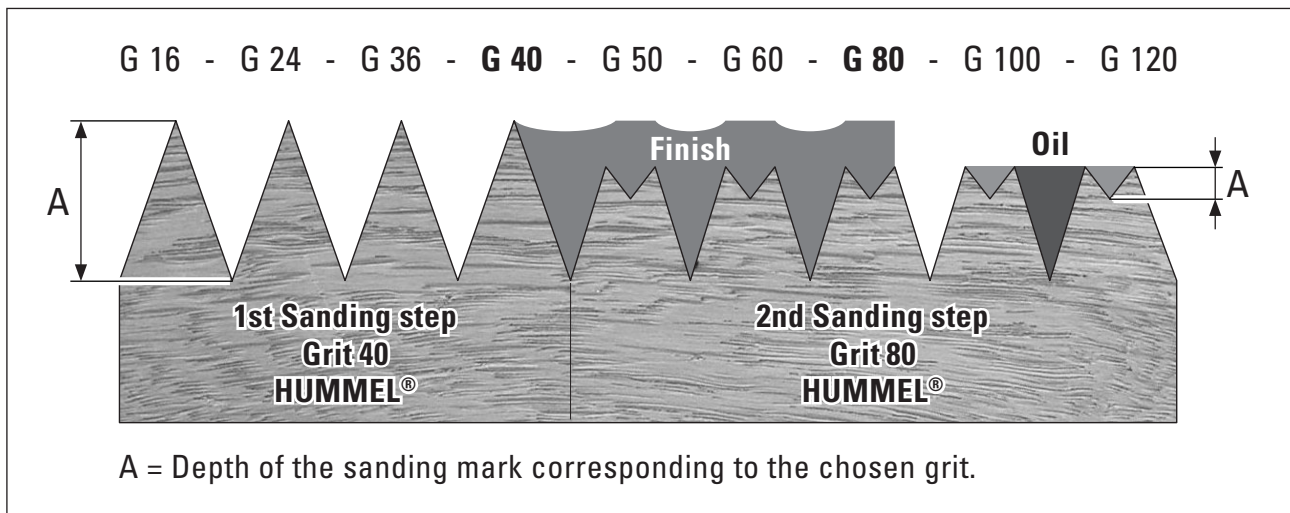


Fig. 9 Defective finish and oil surface with **incorrectly** selected grit sequence.

NOTE:

The correct selection of the grit sequence is even more important for oiled surfaces than for finished surfaces, because fine sanding marks can also have a negative effect on the result. **It is also always necessary to thoroughly vacuum the surface and expansion gaps immediately before starting every work step.**

The machines have to be serviced routinely and the following points have to be aligned for a premium quality surface.

- Machines (correct selection)
- Abrasive (cutting material)
- Work process (grit sequence)

Application of the machines

6.1 DIFFERENT WAYS OF SANDING

Various methods do exist for sanding wooden floors. The machines are used in different ways for each of these

methods. Two popular procedures are explained in this section.

6.1.1 CONVENTIONAL METHOD

With the conventional method, **pre-sanding** is performed, for example with the HUMMEL® belt sanding machine and the FLIP® edge sanding machine. The same grit is used with the HUMMEL® for every sanding step and for the sanding step immediately following with the FLIP®.

The **fine sanding** is performed using the SINGLE single-disk sanding machine.

6.1.2 METHOD IN ACCORDANCE TO THE PREMIUM SANDING TECHNOLOGY PST®

Pre-sanding:

When sanding in accordance to the **PST®** the HUMMEL® belt sanding machine and the FLIP® edge sanding machine are used for the pre-sanding. As with the conventional method, the same grit is used with the HUMMEL® for every sanding step and for the sanding step immediately following with the FLIP®. The pre-sanding is completed at grit 60.

Fine sanding:

The fine sanding starts with the TRIO and also at grit 60 (**with** flexible Velcro abrasives on the sanding plates or, in the case of clearly visible HUMMEL® sanding marks, **without** flexible Velcro rings).

The finer sanding pattern with the TRIO eliminates the HUMMEL® sanding marks (Fig. 6 and Fig. 8) and thus creates the conditions for a premium surface.

The TRIO can be used to adapt the further processing to the wood species and desired surface treatment up to the final sanding step.

To achieve the most invisible transition possible from edge to field when using the TRIO, **edge sanding is first** performed with the FLIP® and then followed by the field sanding. The same grit is used for every sanding step with the FLIP® and for the sanding step immediately following with the TRIO.

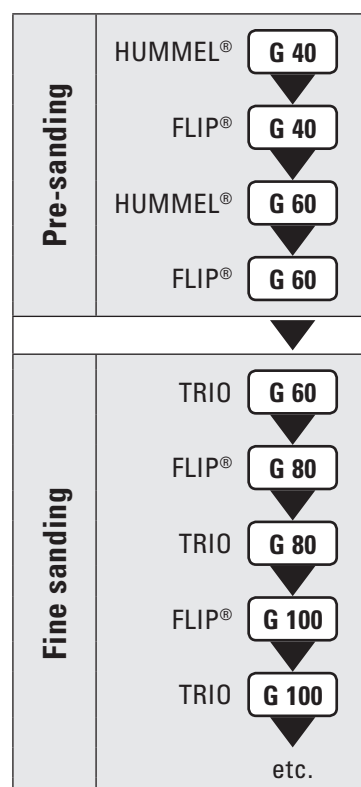


Fig. 10 Example for the sequence of sanding steps in accordance to the **PST®**.

6.2 TIME SAVINGS DUE TO LOWER EXPENDITURE FOR EDGE SANDING

The time expenditure and physical strain required for edge sanding are considerably higher than for field sanding. The following points have to be considered to keep the portion of field sanded with the HUMMEL® as great as possible:

- Time-savings are achieved if the edge is processed with the HUMMEL® parallel to the wall with
 - reduced sanding pressure (FINE setting) and
 - used sanding belt.

- Remove the moldings to sand as closely as possible to the wall with the HUMMEL®.
- The combination with the TRIO additionally makes it possible to save time during edge sanding since the TRIO can be used to sand up to ~ 2" (5 cm) from the wall.

NOTE:

If the individual wood planks are levelled and have low differences in height, then the sanding work can be performed by using the TRIO from the very beginning.

6.3 TIME EXPENDITURE AND PHYSICAL STRAIN

When using the conventional method to sand a room, about 90 % of the field is processed by using the belt sanding machine and the rest by using the edge sanding machine.

Using the TRIO minimizes the area to be processed with an edge sanding machine. This can result in considerable time savings. The physical strain due to edge sanding is reduced in this way by more than half (Fig. 11 and Fig. 12).

Processing a room	Belt sanding machine	Edge sanding machine
Percentage of the entire field	90 %	10 %
Percentage of time spent for the sanding work	75 %	25 %
Percentage of the complete physical strain	60 %	40 %

Fig. 11 Conventional method.

Processing a room	Belt sanding machine HUMMEL®	Edge sanding machine FLIP®	Fine sanding machine TRIO
Percentage of the entire field	40 %	5 %	55 %
Percentage of time spent for the sanding work	50 %	10 %	40 %
Percentage of the complete physical strain	45 %	15 %	40 %

Fig. 12 Method in accordance to the Premium Sanding Technology PST®.

Important points when working with the HUMMEL® belt sanding machine

7.1 METHOD OF OPERATION

As shown in Fig. 13, sanding with a belt sanding machine or a drum sanding machine **should always be carried out from LEFT to RIGHT**. This allows the left side wheel to run on the newly sanded field. This makes the wood flooring more even by every sanding step and prevents waviness.

The sanding drum has to be gently lowered during the machine's forward motion at the start of a sanding path and gently lifted at the sanding path's reversal point. The same applies for the reverse motion. This avoids drum marks.

It is recommended to vary the starting position of the sanding paths to prevent excess stripping in the starting area.

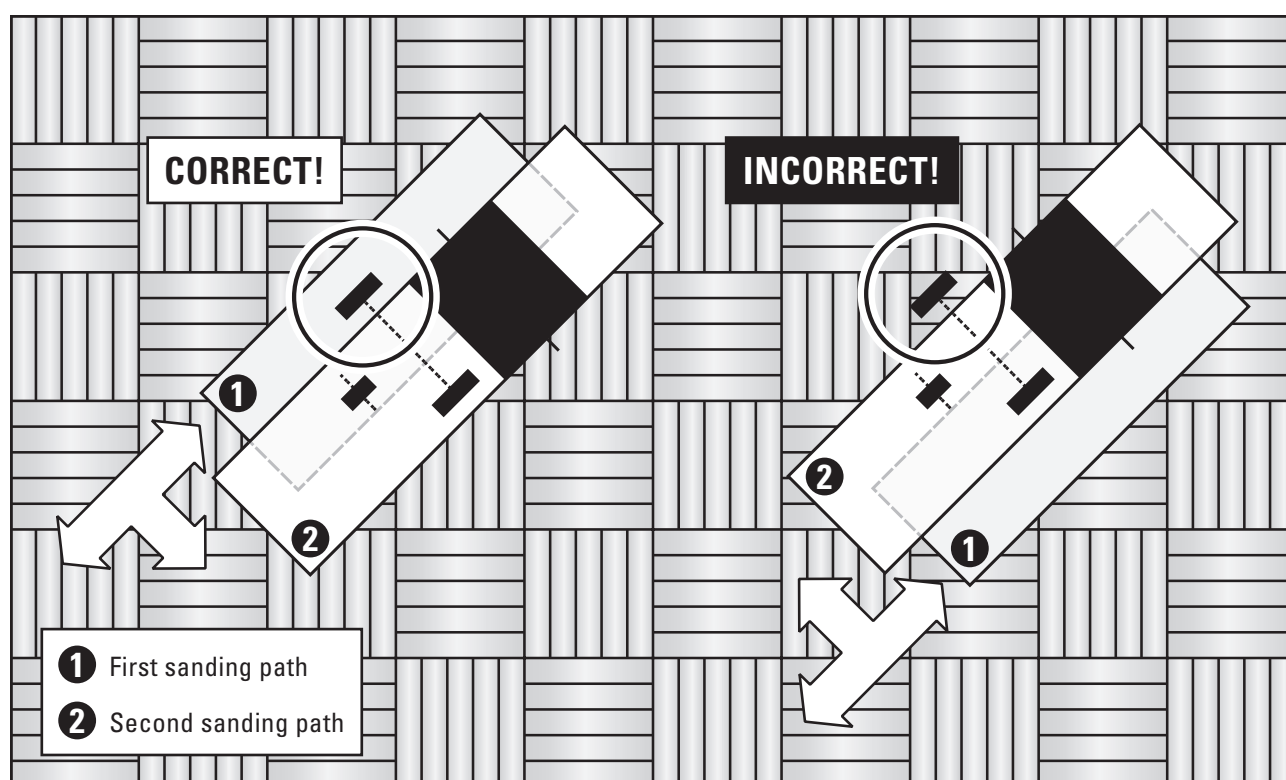


Fig. 13 Right and wrong direction for the sanding path displacement.

7.2 SANDING PATH DISPLACEMENT

A sanding path consists of a forward **and** reverse sanding motion on the same path **without** displacement of the sanding drum (Fig. 14).

The rubber coating of the sanding drum has a slightly spherical shape in order to prevent edges at the drum's lateral ends. **The ideal sanding path displacement is half the width of one sanding drums width (50 %; Fig. 14 left)** in order to avoid a visible difference at the transition from one path to the next and to keep the field as flat as possible.

Using a sanding path displacement of more than 50 % of the sanding drum width, the number of sanding paths can be reduced, but the following **disadvantage** will result:

The areas covered by the sanding paths displacement are sanded twice as often as the areas not covered (Fig. 14 right). This causes an irregular sanding pattern and worsens the flatness of the wood flooring.

LOW SANDING PATH DISPLACEMENT

➔ HIGH STRIPPING RATE!

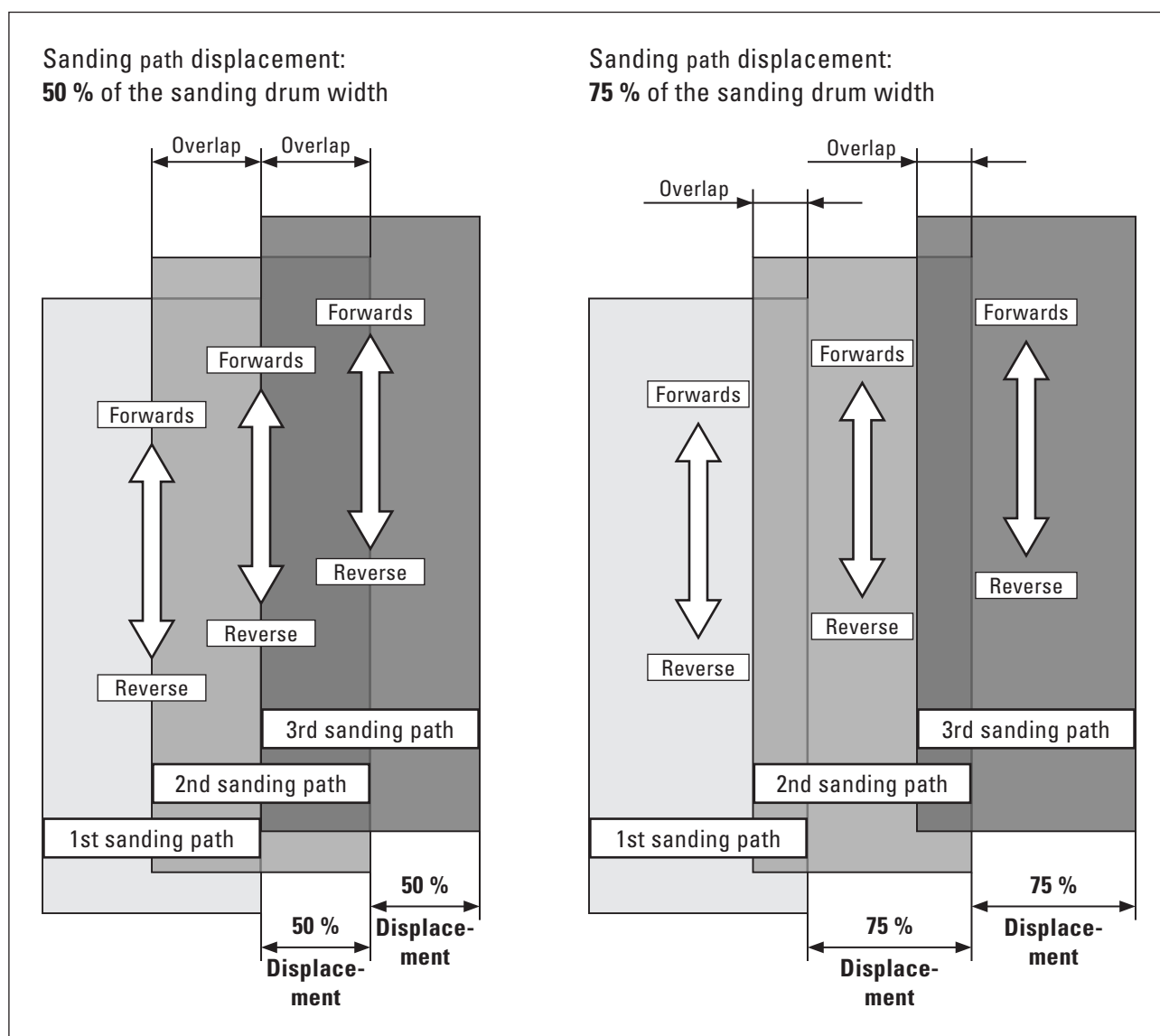


Fig. 14 Increasing the sanding path displacement reduces the evenness of the wood flooring.

7.3 SANDING PRESSURE SETTING

Three different sanding pressures can be set on the HUMMEL® :

COARSE (GROB) / MIDDLE (MITT.) / FINE (FEIN).

The sanding pressure should be adjusted to the grit used and decreased as the grit becomes finer (Fig. 15).

NOTE:

The sanding grits penetrate more deeply into the wood when sanding soft wood flooring than with harder wood species. For this reason, soft wood flooring should be sanded with lower sanding pressure, finer grits and higher walking speed (see *section 7.4, Walking speed*) than harder wood flooring.

**HIGH SANDING PRESSURE
➔ HIGH STRIPPING RATE!**

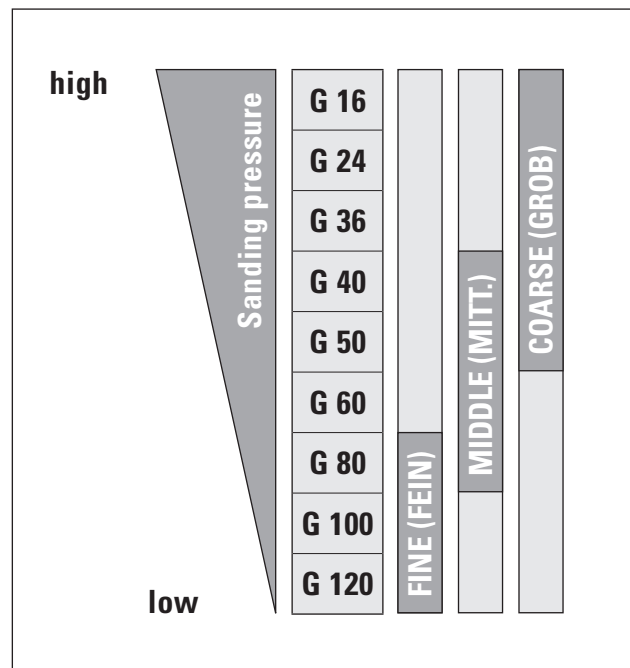


Fig. 15 Sanding pressure depending on the grit number.

7.4 WALKING SPEED

The walking speed during a sanding step should be even and not too slow to achieve a good sanding result. Otherwise the risk of sanding marks will increase!

The stripping performance is affected by the walking speed! The finer the grit, the higher the walking speed should be (Fig. 16).

The sanding abrasion is less for **hard woods** than for soft woods. The walking speed should therefore be reduced on hard wood floors.

**FAST WALKING SPEED
➔ LESS STRIPPING!**

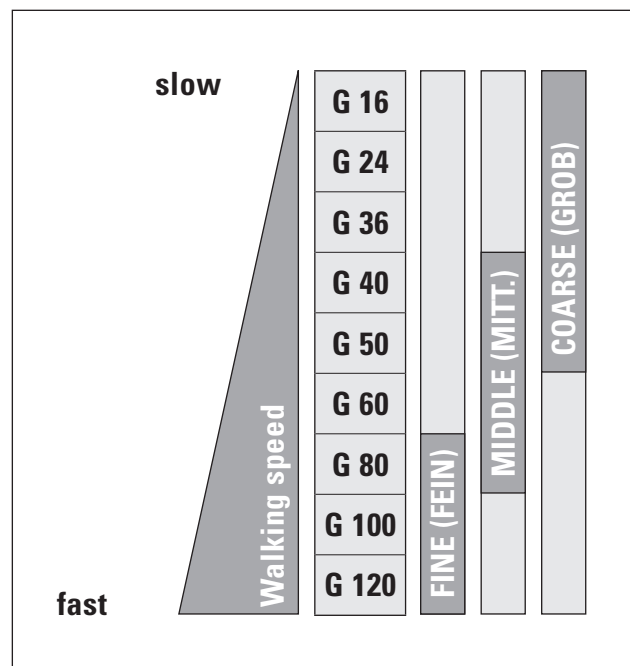


Fig. 16 Walking speed depending on the grit number.

Sanding directions using the HUMMEL® belt sanding machine

8.1 TYPES OF PARQUET AND LAYING PATTERNS WITH THE SAME SANDING DIRECTION

The sanding processes for **pre-sanding** and **fine sanding** should be carried out at a 45 degree angle to the wood

grain direction for the parquet types and layout patterns shown in Fig. 17. This prevents gouging.

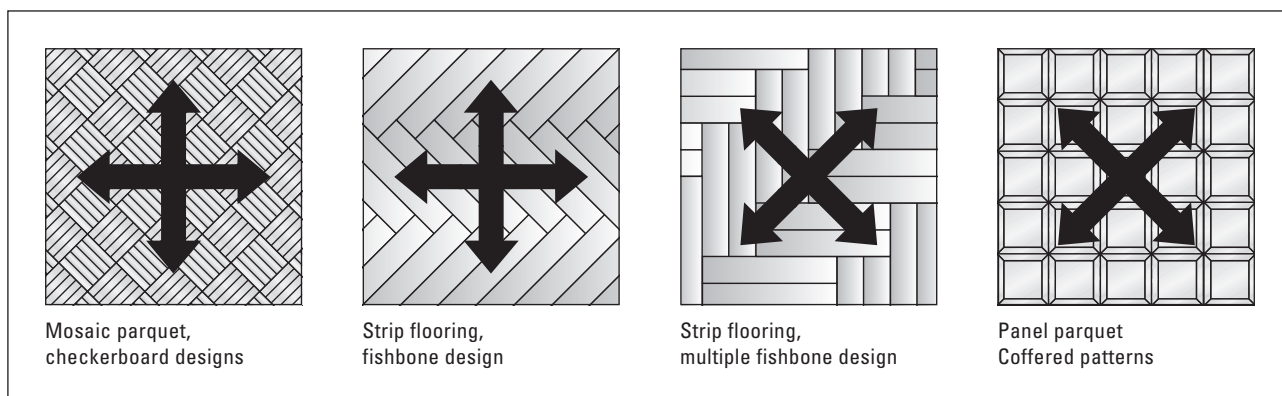


Fig. 17 Sanding direction 45 degrees to the wood grain direction for all sanding steps.

8.2 STRIP FLOORING AND FLOORBOARDS

8.2.1 SANDING DIRECTIONS FOR STRIP FLOORING AND NON-CUPPED FLOOR BOARDS

All of the work steps for strip flooring laid lengthwise or for floor boards **except for the final sanding step** must be carried out at an angle of 15 to 45 degrees to the wood grain direction (Fig. 18). The more uneven the wood flooring is, the greater the angle to the wood grain direction should be.

Exception: Heavily cupped floor boards (see *Section 8.2.2, Special case: cupped floor boards*).

The last sanding step is made with the grain (Fig. 19).

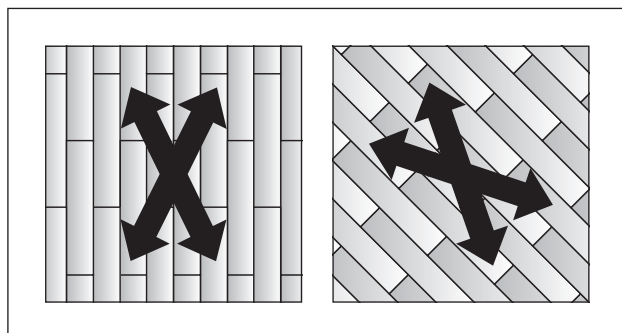


Fig. 18 Sanding direction 15 - 45 degrees to the wood grain direction for the **first to 2nd-last** sanding step.

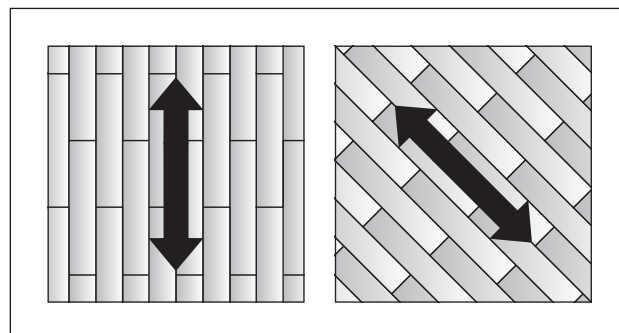


Fig. 19 Sanding direction lengthwise to the wood grain direction for the **final** sanding step.

8.2.2 SPECIAL CASE: CUPPED FLOOR BOARDS

The individual boards of permanently cupped floor boards are arched upwards on the sides (Fig. 20 above)

Cupping is the result of different expansions of the upper and lower sides of a board. This is caused by swelling and shrinking of the wood when it is penetrated on one side by expanding agents such as water.

The risk of cupping increases with the width of a wood element. Floor boards are therefore often affected by this.

The cupped floor boards having large differences in height should be evened out by sanding with the grain in the first work step (Fig. 20 below).

Once the large differences in height have been eliminated the floor boards are sanded as described in *Section 8.2.1, Sanding directions for strip flooring and non-cupped floor boards*.

NOTE:

Always check the moisture content of any cupped floor before sanding.

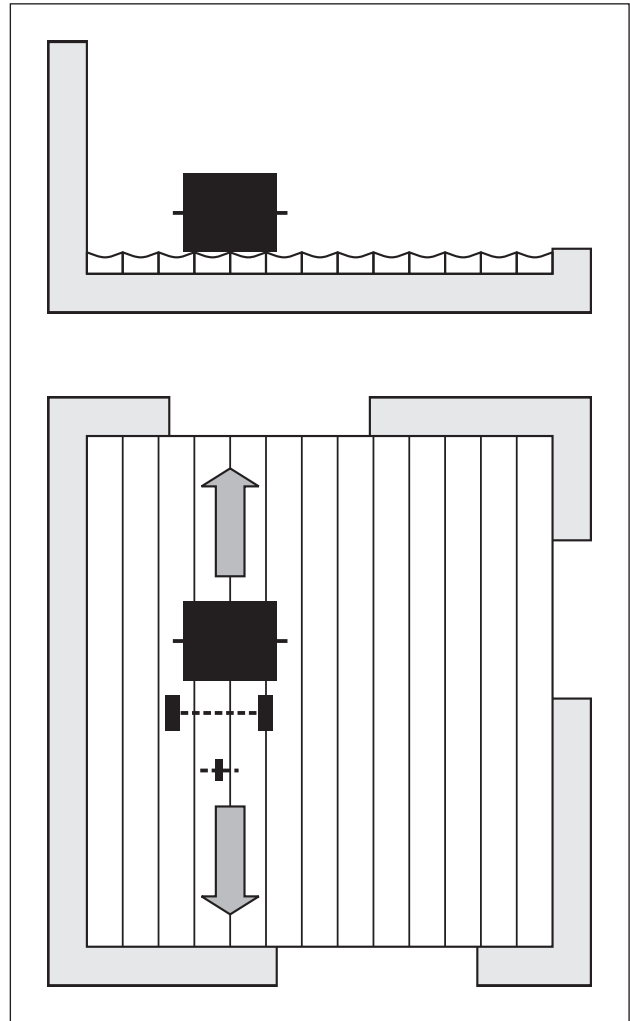


Fig. 20 Leveling heavily cupped floor boards.

8.2.3 SPECIAL CASE: VIBRATING FLOORS

Certain subfloors can lead to vibration of the floor covering. Waves and depressions can form at uniform intervals if a drum or belt sanding machine is used in this case.

In order to prevent this problem with conventional methods, the final sanding step has to be made on lengthwise laid wood flooring at a small angle to the wood grain direction.

NOTE:

Applying **Premium Sanding Technology** with early usage of the TRIO will avoid these problems!

Sanding using the HUMMEL® belt sanding machine

9.1 PREPARATION

9.1.1 CHECKING THE FLATNESS OF THE WOOD FLOORING

The drum lever can be used as follows to check the flatness of the wood flooring when the machine **is switched off**:

- Put on a fine, used sanding belt
- Do **not** switch on the machine
- Lower the sanding drum slowly onto the wood flooring
- If possible, roll the machine diagonally to the wood grain direction over the field
- Note upward and downward movements of the drum lever

Movement of the drum lever **upwards** indicates a **rise** in the wood flooring.

Movement of the drum lever **downwards** indicates a **lowering** in the wood flooring.

If the drum lever moves only slightly, then the wood flooring is relatively even. Larger movements indicate corresponding unevenness.

Lightly marking highly uneven locations with a pencil is recommended for achieving a better overview.

9.1.2 PERFORMING A TEST SANDING OPERATION

Test sanding checks whether the selected grit is suitable for the subsequent sanding step. It is necessary to perform the test sanding with the finest grit possible to prevent deep sanding marks.

If this test sanding is satisfactory and a good result can be seen within a reasonable time, then the sanding work can be started with this grit. Otherwise, additional test sanding has to be performed with a coarser grit.

9.2 SANDING METHOD

The following points are particularly important for sanding and should be considered.

- The sanding direction has to be determined in accordance to the type of parquet, strip flooring and their laying pattern (also see *Section 8, Sanding directions using the HUMMEL® belt sanding machine*).
 - The first sanding step is started at the same grit which produced a satisfactory test sanding (also see *Section 9.1.2, Performing a test sanding operation*).
 - The surface and the expansion gaps have to be vacuumed after every sanding step. The further approach is decided after an assessment of the surface has been made.
- If the result is not satisfactory, then the previous sanding step should be repeated crosswise.**
- In accordance with the conventional method, the fine sanding can also be carried out using the HUMMEL® (see *Section 6.1.1, Conventional method* and Fig. 21).
 - The usage of the TRIO for fine sanding achieves a more even and uniform surface than using the HUMMEL®. The combination of HUMMEL® for pre-sanding and TRIO for fine sanding is a basic component of our **Premium Sanding Technology PST®** (see *Section 6.1.2, Method in accordance to the Premium Sanding Technology PST®*, and Fig. 22 and Fig. 31).

9.3 HUMMEL® PROCESSING PLAN FOR CONVENTIONAL METHODS

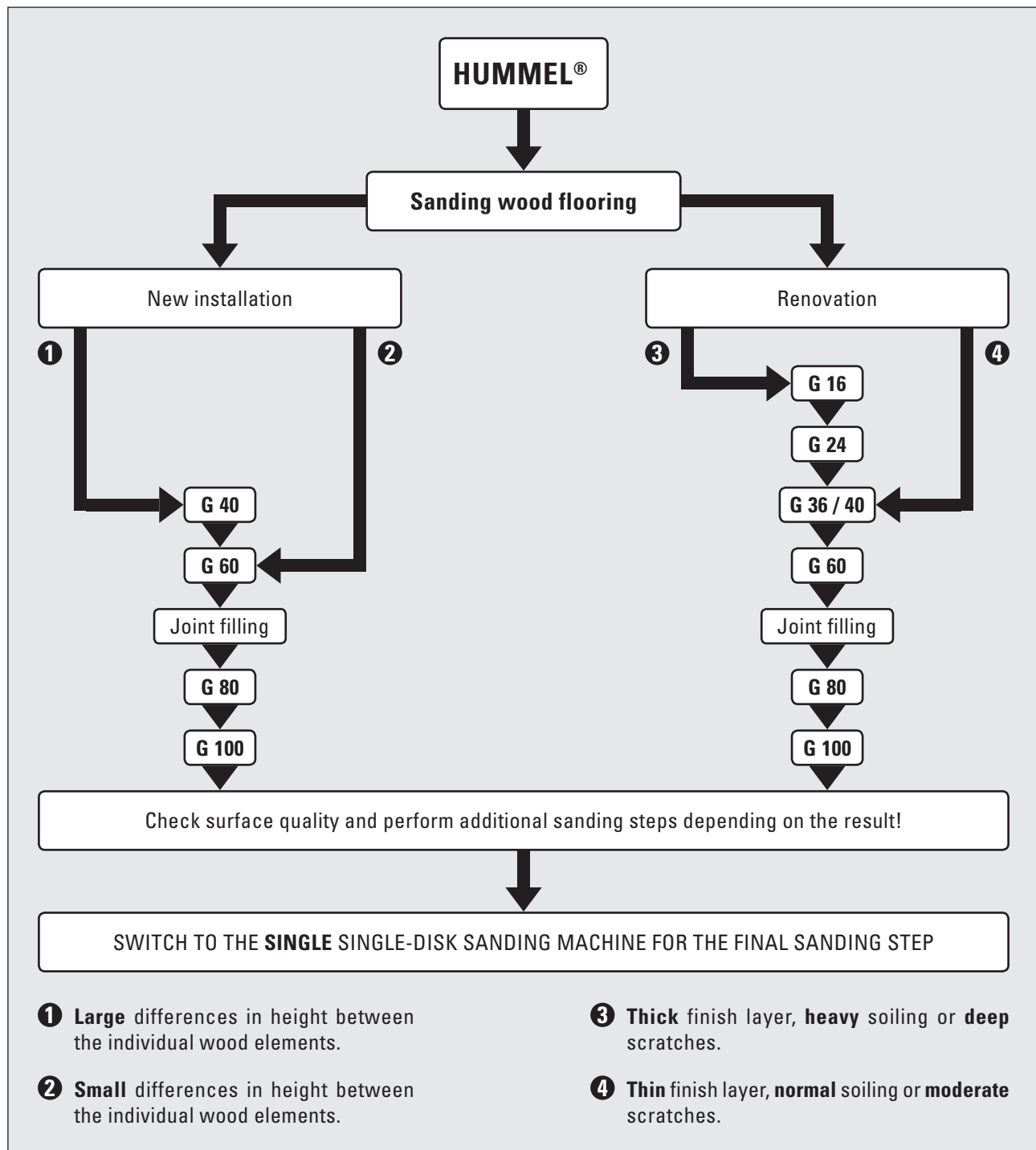


Fig. 21 Processing plan of the HUMMEL® belt sanding machine for the conventional method.

9.4 HUMMEL® PROCESSING PLAN FOR THE PST® METHOD

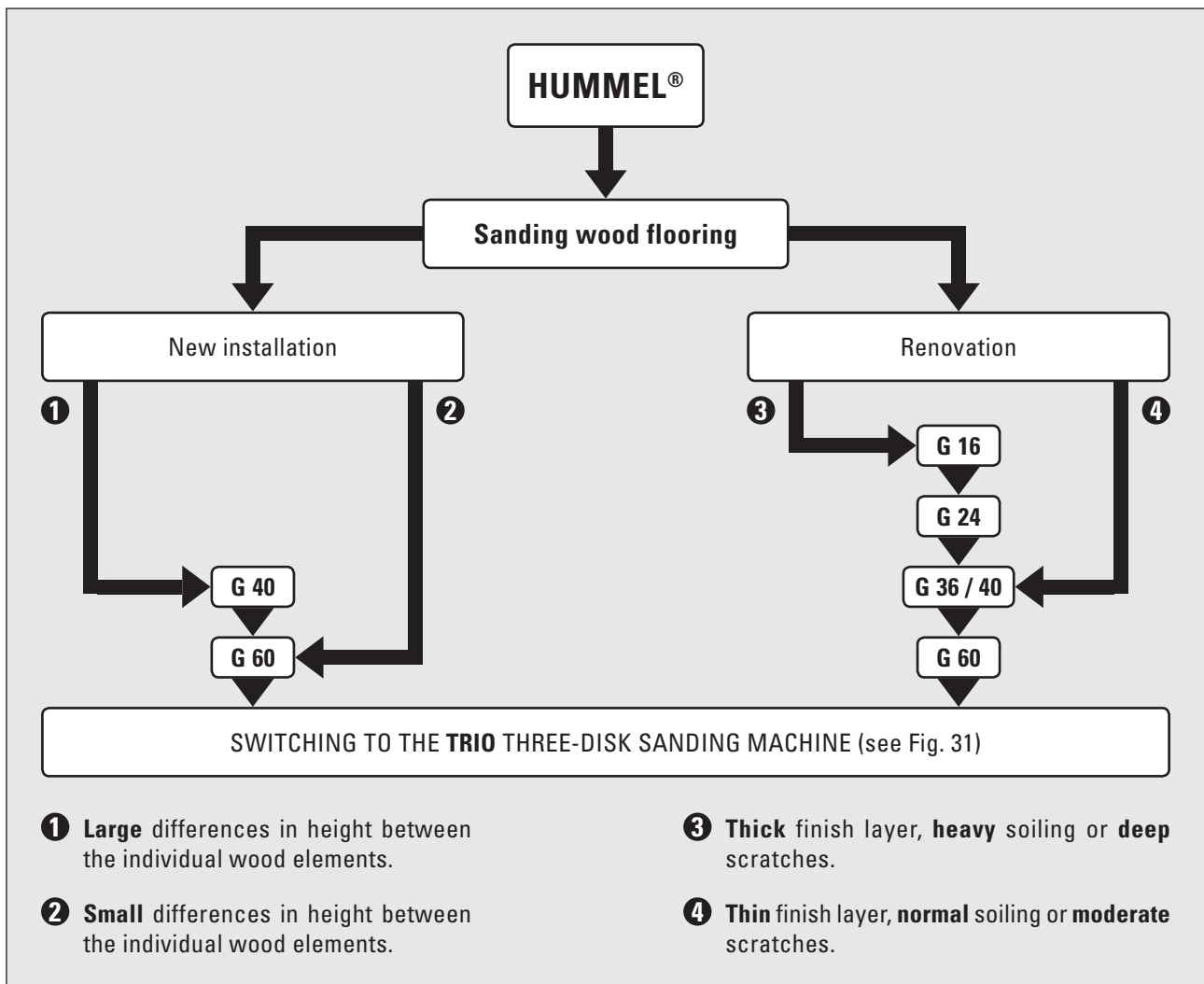


Fig. 22 Processing plan of the HUMMEL® belt sanding machine for the method corresponding to PST®.

Sanding using the FLIP® edge and corner sanding machine

10.1 SANDING PRESSURE

The wheels are used to set the sanding pressure and thus the aggressiveness of the abrasive for the FLIP®. With a flat machine setting (Fig. 23) the sanding plate rests with a larger field on the floor (Fig. 24, **A**) as opposed to a steep machine setting (Fig. 25 and Fig. 26, **B**).

The abrasive's aggressiveness increases with the steepness of the machine setting. This, however, increases the risk of deep gouges which can then only be evened out with great effort.

NOTE:

The precise method for setting the wheel is described in the FLIP® operating manual.

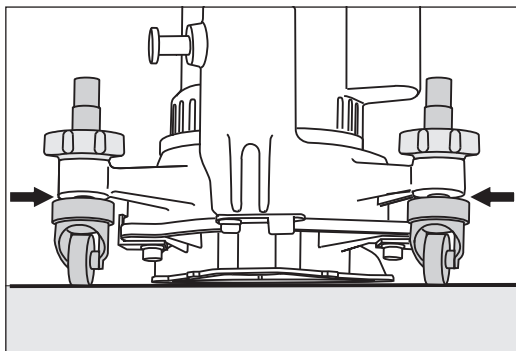


Fig. 23 Flat machine setting for **fine** sanding work.

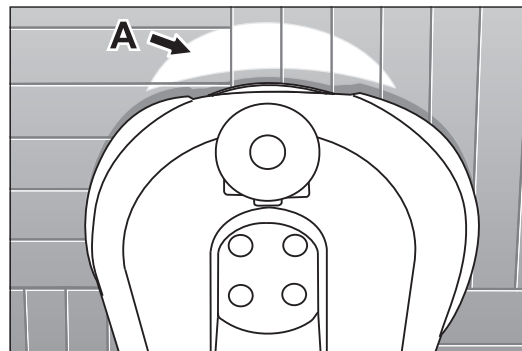


Fig. 24 Large sanding field **A** and thus **low** abrasive aggressiveness.

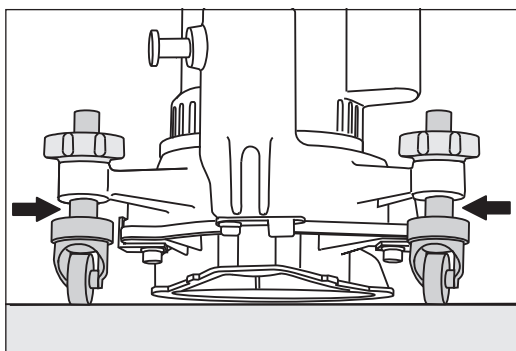


Fig. 25 Steep machine setting for **coarse** sanding work.

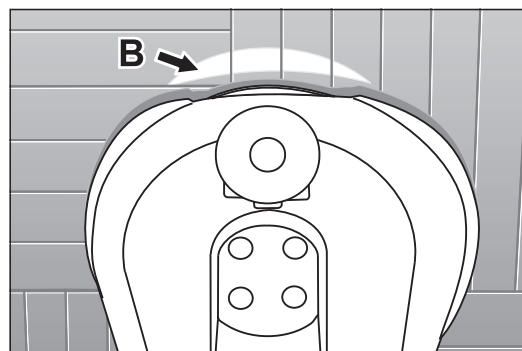


Fig. 26 Small sanding field **B** and thus **high** abrasive aggressiveness.

10.2 SANDING METHOD

The FLIP® is a lightweight, compact edge sanding machine with a sanding plate diameter of ~ 6" (150 mm). It is not only suitable for sanding edge areas but also for sanding corners with the optionally available corner attachment.

The machine with a **short or long attachment** is guided along the edge with circulating clockwise movements (Fig. 27). Excessive sanding pressure by the operator reduces the sanding plate speed and results in a poorer sanding pattern, burn marks and unnecessary stress on the machine.

The machine always has to be kept in motion during the sanding work to prevent sanding marks.

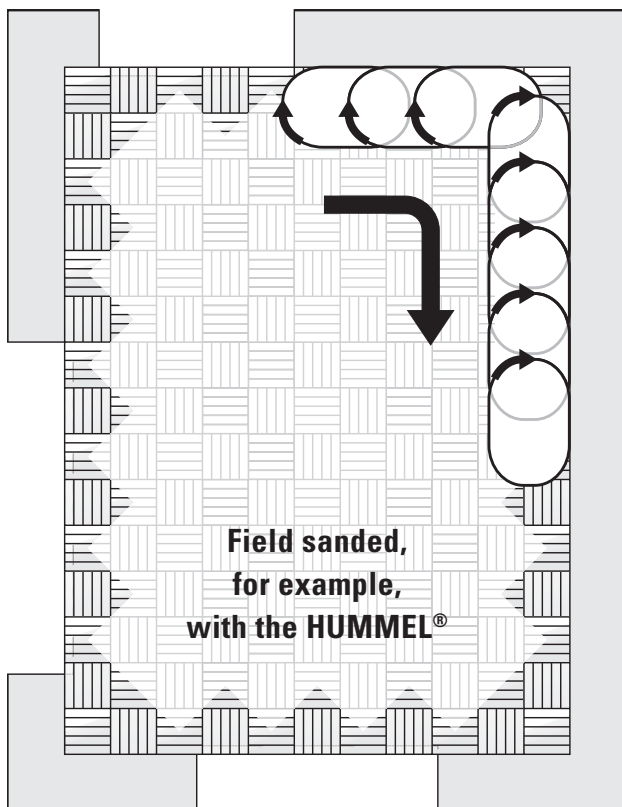
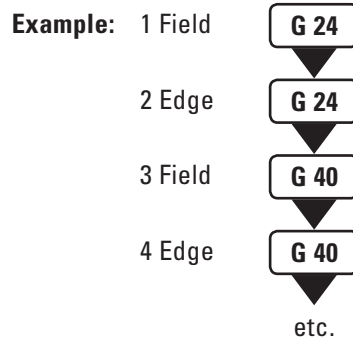


Fig. 27 Direction of movement of the FLIP® with a **short or long attachment**.

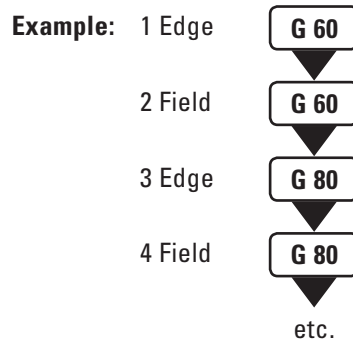
IMPORTANT:

The following sanding step sequence has to be maintained to keep the transition area between the edge and the remaining field from being noticeable.

Always use the same grit for field sanding with a **drum or belt sanding machine** and for the **subsequent** sanding step with the edge sanding machine:



Always use the same grit with a **single-disk or three-disk sanding machine** as in the **previous** sanding step with the edge sanding machine.



Exception:

Edge sanding with the FLIP® achieves more stripping than with the TRIO or SINGLE.

Therefore the first edge sanding after filling the joints can be carried out using grit 80 instead of grit 60 (compare Fig. 28 with Fig. 31 and Fig. 32).

10.3 FLIP® PROCESSING PLAN

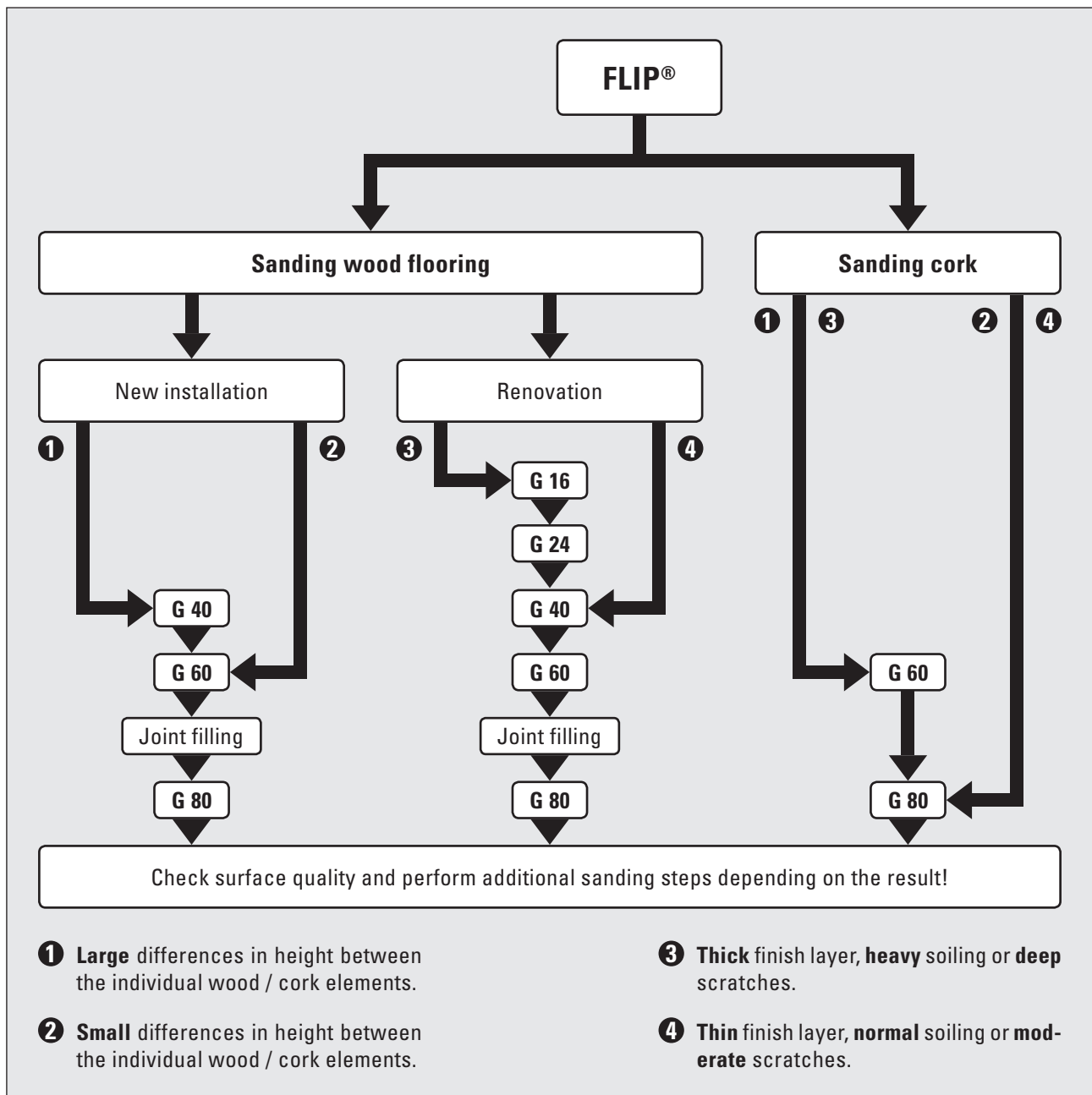


Fig. 28 Processing plan of the FLIP® edge and corner sanding machine.

10.4 FLIP® CORNER ATTACHMENT

The FLIP® corner attachments sanding plate diameter is ~ 2 3/8" (60 mm). It is excellently suited for the area around heating pipes and for corners. These areas can be quickly processed in a high quality.

The high speed of the sanding plate with the corner attachment achieves a high level of stripping (highly aggressive).

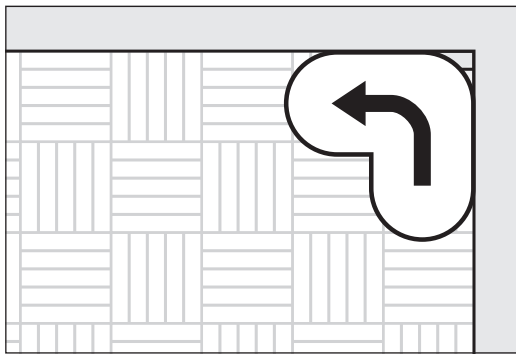


Fig. 29 Direction of movement of the FLIP® with **corner attachment**.

The following points have to be considered to prevent deep gouges when sanding with the corner attachment:

- A flexible Velcro ring **always** has to be positioned between the sanding plate and the sanding disk when the corner attachment is used.
- The FLIP® wheels have to be set the same way as for machines with a short attachment (see FLIP® operating manual)!
- In contrast to work with the other attachments, the sanding has to be carried out **counter-clockwise** (Fig. 29)!
- No pressure on the sanding plate!
- Velcro sanding disks with the finest possible grit should be used!

Sanding using the TRIO three-disk sanding machine or the SINGLE single-disk sanding machine

11.1 FINE SANDING USING THE TRIO

11.1.1 SANDING METHOD

The ideal range of usage for the TRIO is fine sanding with grits starting at 60 and intermediate finish sanding!

The TRIO's functionality offers the following advantages:

- As opposed to a belt sanding machine, a finer surface is achieved when using abrasives at the same grit.
- No particular sanding direction has to be followed (Fig. 30).

Fine sanding using the TRIO generally begins with Velcro sanding disks starting at grit 60 and can be carried out up to grit 150 depending on the wood species and the subsequent surface treatment.

An additional sanding step with sanding screen must be carried out after the final sanding step to achieve a premium surface. The sanding screen's grit must be the same as the grit used for the Velcro sanding disks of the previous sanding step!

The TRIO can also be used for pre-sanding with Velcro sanding disks starting at grit 40 in cases of **minimal over / under wood** (Fig. 31).

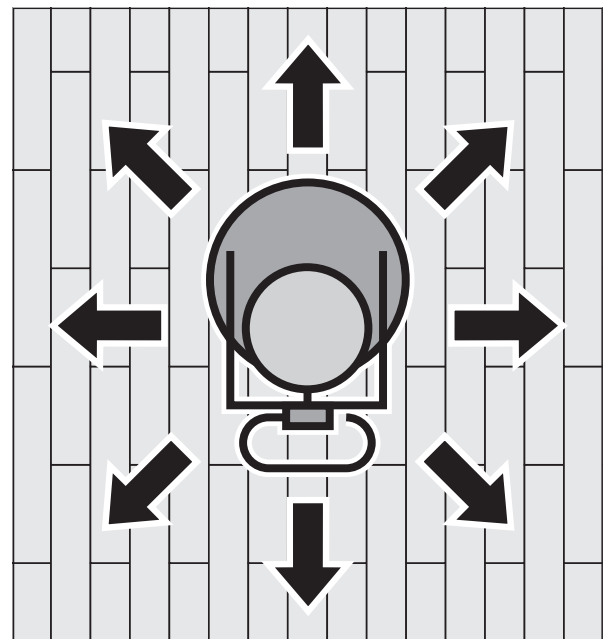


Fig. 30 Sanding directions using the **TRIO**.

11.1.2 HINTS FOR FINE SANDING USING THE TRIO

- In order to achieve a high quality surface when using the TRIO the following conditions have to be met (also see *Section 5.2, Correct choice of the grit sequence*):
 - **No more than one** grit number was skipped when pre-sanding with the belt sanding machine!
 - **No** grit number was skipped when fine sanding with the TRIO!
- The sanding abrasion can be reduced by removing the additional weight from the TRIO.
- The sanding abrasion can be reduced by attaching two flexible Velcro rings to each sanding plate.
This is particularly advantageous when sanding uneven engineered flooring to prevent the top layer from being sanded through.
- The sanding abrasion can be increased by removing the Velcro rings from the TRIO sanding plates.
- The sanding abrasion depends on the walking speed during sanding. Decreasing the walking speed increases the sanding abrasion.
- Excessively slow walking speeds or continuous sanding at the same point creates too much heat which can cause burn marks on the wood flooring and clogging of the abrasive. Therefore it is recommended, if required, to sand the same area repeatedly at appropriate time intervals.
- The wood species and the surface treatment to be carried out after the fine sanding determines the grit number of the final sanding step (see *Section 14, Final sanding step*).
- The TRIO can also be used for intermediate finish sanding with sanding screen (see *Section 15.3, Intermediate finish sanding with the TRIO or the SINGLE*).
The application of a used sanding screen and the removal of the additional weight are recommended to reduce the risk of sanding through the finish layer during intermediate finish sanding.
- Sanding pads can also be used on the TRIO for the intermediate finish layer.
- The following points must be considered when sanding cork:
 - Never sand with abrasives coarser than grit 60.
 - Always remove the additional weight from the TRIO.
 - Sanding without the flexible Velcro ring on the sanding plates.

11.1.3 TRIO PROCESSING PLAN FOR THE PST® METHOD

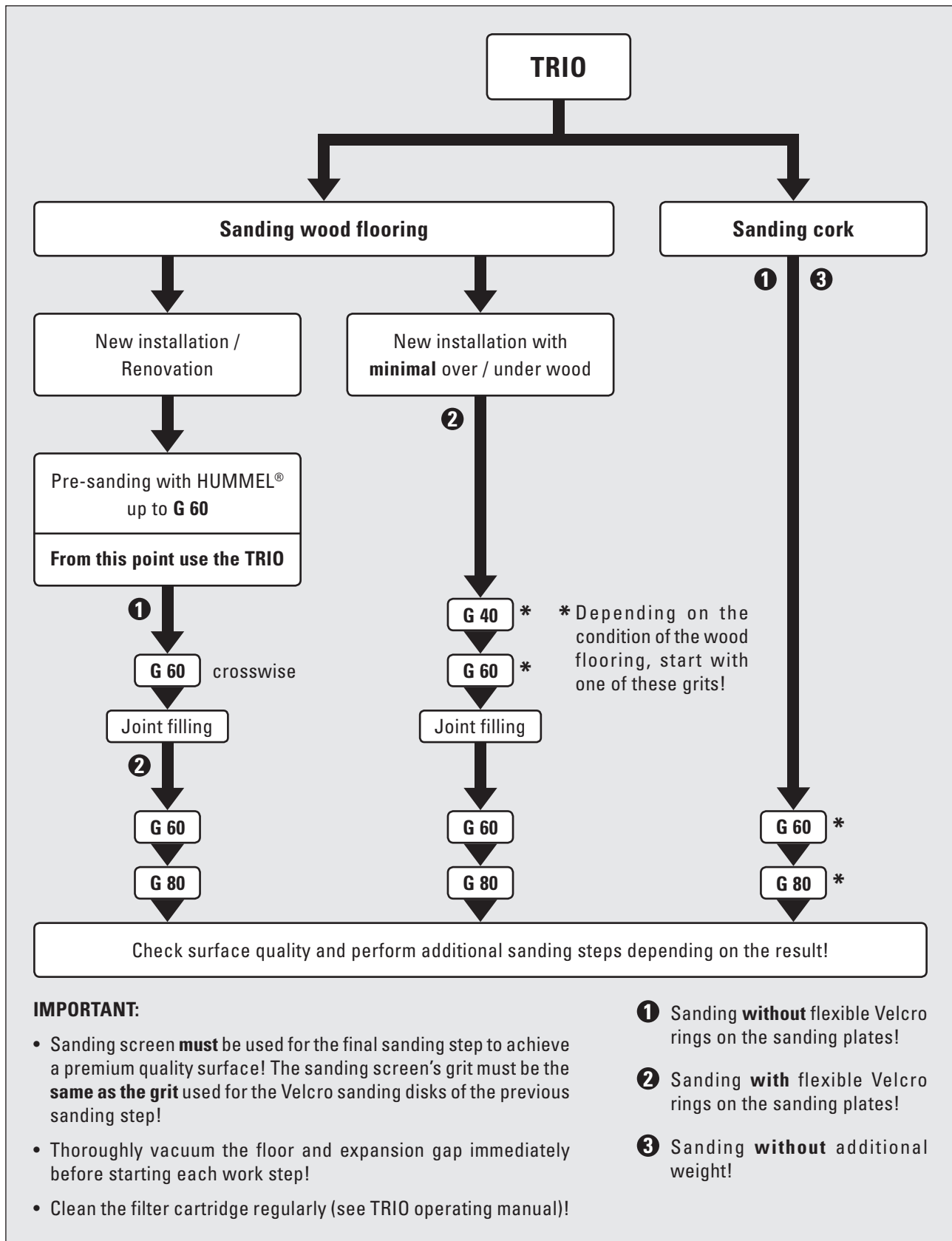


Fig. 31 Processing plan of the TRIO three-disk sanding machine for the PST® method.

11.2 FINE SANDING USING THE SINGLE

The SINGLE is a powerful single-disk sanding machine, which can be used for both subfloor treatment (see *Section 2.3, Subfloor treatment using the SINGLE*) and for fine and intermediate finish sanding.

Fine sanding using the SINGLE generally begins with abrasive starting at grit 80 and ends with grit 100 or finer depending on the wood species and the subsequent surface treatment.

The SINGLE can also be used for pre-sanding with abrasives starting at grit 40 in cases with **minimal over / under wood** (Fig. 32).

IMPORTANT:

The LÄGLER® Velcro sanding rings are best suited for wood sanding using the SINGLE!

If **non Velcro abrasives** are used for the SINGLE, then the flexible Velcro ring on the sanding plate must be removed!

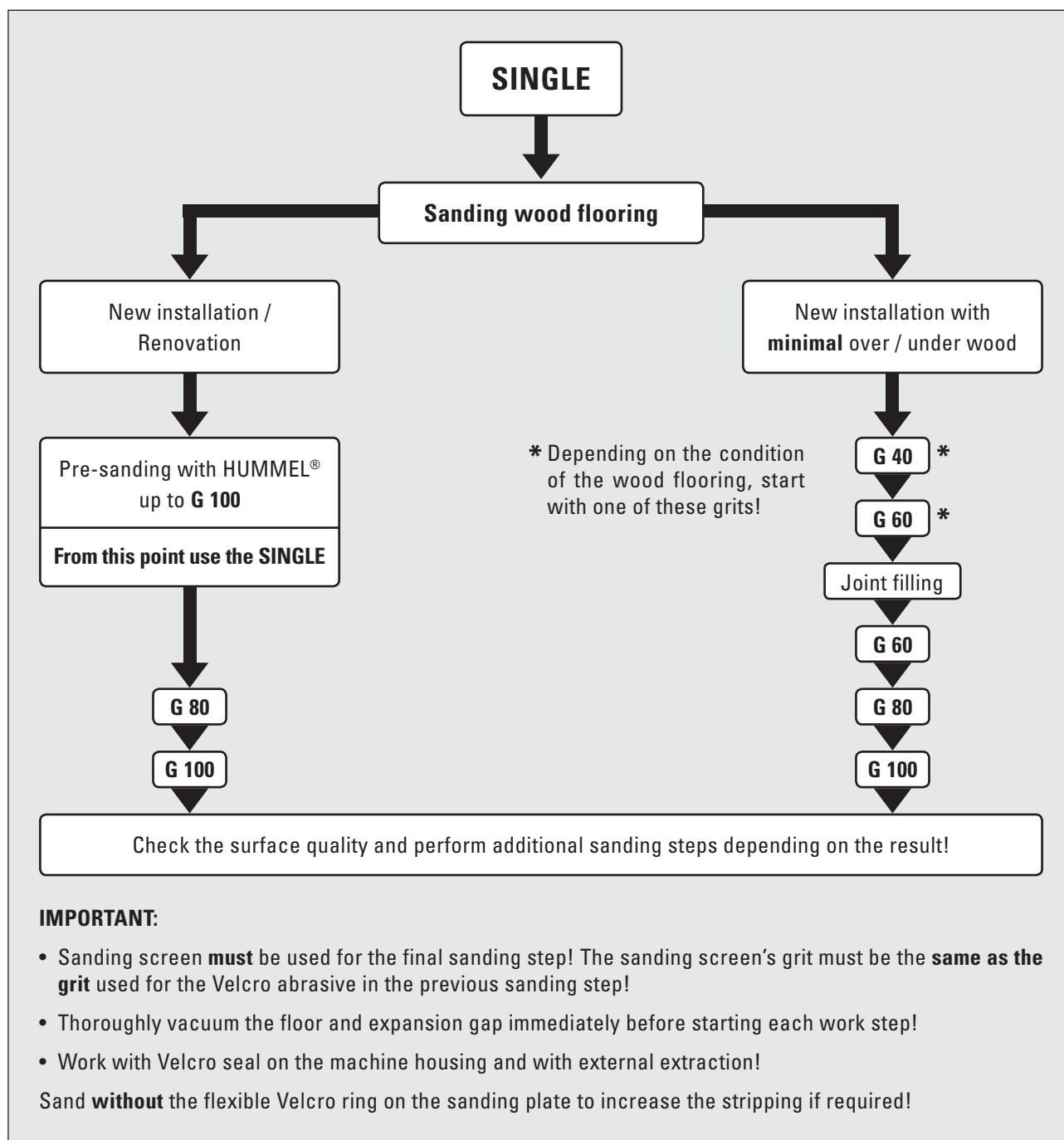


Fig. 32 Processing plan of the **SINGLE** single-disk sanding machine.

Sanding using other LÄGLER® machines

12.1 FLOOR SANDING MACHINES

SUPERHUMMEL

The SUPERHUMMEL belt sanding machine was developed for processing large surfaces in schools, gymnasiums, and industrial buildings. Its powerful motor and ~ 12" (300 mm) drum width makes it particularly suitable for the efficient sanding of larger surfaces. The SUPERHUMMEL is in Europe only available as a three-phase A.C. current model.

The methods used for sanding with the SUPERHUMMEL and with the HUMMEL® are similar; see the HUMMEL® processing plan, Fig. 21.

NOTE:

Pressure setting works the other way round than on HUMMEL®.

PROFIT

The PROFIT drum sanding machine is a lightweight and handy sanding machine which is primarily used in the rental market. It is standard equipped with a ~ 8" (200 mm) wide LÄGLER® centrifugal sanding drum and extremely easy to operate. The methods used for sanding with the PROFIT and with the HUMMEL® are similar; see HUMMEL® processing plan, Fig. 21.

Due to the lower stripping power as opposed to the HUMMEL®, sanding steps may need to be repeated several times.

ELF

The ELF drum sanding machine is available with a LÄGLER® centrifugal sanding drum or a conventional split drum (drum width ~ 8" (200 mm) or ~ 12" (300 mm)). The ELF is particularly sturdy, easy to handle, maintenance-friendly, and easy to clean.

The methods used for sanding with the ELF and with the HUMMEL® are similar, see HUMMEL® processing plan, Fig. 21.

12.2 EDGE SANDING MACHINES

ELAN

The ELAN is a lightweight, compact edge sanding machine with a sanding plate diameter of ~ 6" (150 mm) which is not only suitable for sanding edge areas but also for sanding wooden staircases. It is available with a short or long attachment.

The methods used for sanding with the ELAN and with the FLIP® are similar; see FLIP® processing plan, Fig. 28.

UNICO

The UNICO is a sturdy sanding machine with a sanding plate diameter of ~ 7" (178 mm), which is particularly well suited for sanding larger edge areas. It is available in the attachment lengths ~ 4 1/8" (105 mm), ~ 9" (230 mm) or ~ 13 3/4" (350 mm).

The methods used for sanding with the UNICO and with the FLIP® are similar; see FLIP® processing plan, Fig. 28.

Removal of cracks and joints

The wood flooring must be checked for cracks and joints before the final sanding step. These often only become visible during sanding.

Excessively large cracks and joints can no longer be permanently closed with commercially available filler. They must be treated as described in *Section 3.2, Filling joints*.

Smaller cracks and joints can be easily closed by using filler which should be applied in accordance to the manufacturer's instructions. The work step required for this is usually referred to as "filling the joints".

The filler is prepared by mixing a filler solution with the fine sanding dust from the previous TRIO sanding step to create a pasty compound. This ensures that the wood species color and the color of the filler optimally matches the wood flooring.

The entire field has to be evenly filled with a rust-free (stainless steel) trowel to completely close the joints. Please ensure that the filler can penetrate the joints well to achieve a good result. The joints cannot be closed well and then break more easily after drying if the filler is not moist enough during processing.

The filler should not be applied too thickly to prevent subsequent sanding of the wood floor.

If scheduling and cost planning allows, then it is also possible to fill the joints in two consecutive steps, first by using a more liquid filler and then by using a more solid filler. The more liquid filler penetrates deeply into the joints during the first filling process. The more solid filler then closes the upper area of the joints during the second filling process. This fills the joints completely and decreases the likelihood of the filler breaking off.

Please note the fillers drying time.

The excess filler must be removed by a sanding step after the filling and the filler's drying time (see processing plans Fig. 21, Fig. 28, Fig. 31, Fig. 32). **No filler residues** should remain on the surface of the wood flooring.

The abrasive can clog more quickly when sanding off the filler as in the previous sanding steps. This can cause burn marks, particularly when sanding edges. In such a case, the abrasive has to be changed **more often**.

All of the joints must be completely closed before the surface treatment is started.

NOTE:

The filling of the wood flooring not only optimizes the result but also reduces the material consumption during surface treatment.

Final sanding step

The grit of the abrasive used for the final sanding step depends on the wood species and the subsequent surface treatment. Therefore no recommendation can be made at this point for the grit of the final sanding step.

Wood flooring generally has to be sanded with finer grit when oil or wax is being used. The grit sequence has to be expanded accordingly to include finer grits.

The deeper the sanding marks, the more oil or wax can penetrate and make these indentations appear darker. Deep sanding marks are therefore much more visible than with finishing. The usage of colored oils and stains will even reinforce this effect.

IMPORTANT:

An even and fine surface structure of the wood flooring is particularly important for colored oil or stain. The deeper the sanding marks, the more color pigments can deposit in them. The sanding marks therefore appear even darker than with normal oil. A surface treated with colored oil or stain is therefore generally sanded with one grit number finer.

It is up to the contractor, however, to judge whether the surface quality following the final sanding step is suitable for the corresponding surface treatment.

Refer to finish manufacturers instructions.

The following points have to be considered and checked after completion of the sanding:

- No more cracks or joints should be visible. Otherwise they have to be closed by using filler (see *Section 13, Removal of cracks and joints*).
- No more sanding marks from the coarse grits should be visible. With the help of a flash light, existing sanding marks will become clearly visible. Such faults will stand out after the subsequent surface treatment. Due to differences in the brightness of the field. This can result in customer complaints.
- Differences in the roughness of the wood surface between the field and edge sanding lead to different brightness levels after the following surface treatment (picture frame).
Using the TRIO, the edges have to be sanded **first** by using sanding disks at same grit as that of the TRIO sanding screen. This prevents differences in the brightness level of the finished or oiled / waxed surface.
- No more damage or other defects should be visible on the surface after the final sanding.
- The surface should be inspected for foreign particle residues (e.g. iron filings, plaster residue). Small iron particles can lead to brown spots (rust spots) in the finish coating, especially if the floor is coated with water-based finish.
- No contaminants such as oils, greases, wax, resin, cleaning agents or substances containing silicone may be present on the surface. These substances can impair the bonding of the wood surface with the finish, oil or wax and lead to complaints by the final customer.

Finishing of wooden floors

15.1 INSTRUCTIONS FOR FINISHING

The following points have to be considered before starting the finishing:

- The wood flooring should not have any defects or damages.
- The field has to be dry and free of oil, grease, wax, resin, cleaning agents, old coatings and substances containing silicone.
- Keep the windows, and if possible, the doors closed and shut off air conditioning to prevent drafts.
- Everything in the room (e.g. door frames, window sills, heaters, wood flooring, expansion gaps) must be thoroughly vacuumed immediately before starting the finishing work to prevent dust from depositing on the freshly finished surface.
- Close the blinds if applicable since the surface must be allowed to dry after every finish coat without exposure to dust and sunlight.

Always follow the processing instructions in the data sheets of the finish manufacturer (coating quantity, method, processing temperature, residence time, potlife, drying time, etc.)!

The following sequence must be met to prevent the need for walking on the freshly finished fields:

- First use a small finishing roller or paint brush to finish the areas around the heater pipes, door frames, corners and similar points.
- Then use a large finishing roller or applicator to evenly coat the remaining field working towards the door. Try to work with the light so that you can observe your work and avoid unevenly applied finish and missed spots.

Finishing at excessively high temperatures (see the finish manufacturer's data) is not recommended since the excessively fast drying can cause poor distribution of the finish, visible transitions or trapped air. It can be advantageous in this case to perform the work early in the morning or late in the evening **with adequate artificial lighting**.

The wood floor should not be used until the finished surface is completely dry (observe the finish manufacturer's data)!

The following points should be considered to prevent complaints:

- The customer should be informed in advance about the options of modern finishes.
- Differences in the absorbency of various wood species can lead to deviations in the brightness of individual elements after finishing.
- The customer should be informed that minor flaws such as paintbrush hairs since they can never be completely avoided due to the conditions typically prevailing at construction sites.
- Clearly visible brush strokes or material accumulations must be avoided. If the customer complains about such defects they have to be eliminated by repeat sanding and finishing of the wood flooring.
A finished floor should be evaluated in a standing position in normal, ambient lighting.

15.2 FINISHING METHOD

THE WOOD FLOORING AND THE EXPANSION GAPS MUST BE THOROUGHLY VACUUMED AFTER EVERY SANDING STEP!

Finishing using a primer

Most finishing systems consist of three layers. A primer is often applied as the first coat. The primer ensures optimal adhesion between the wood and finish and reduces the side-bonding effect of the finish.

The surface is **not intermediately sanded after the primer coating**. Instead, the first finish layer is applied. The intermediate finish sanding step is carried out after the first finish layer has dried. The exact sequence of the work steps is shown in Fig. 33.

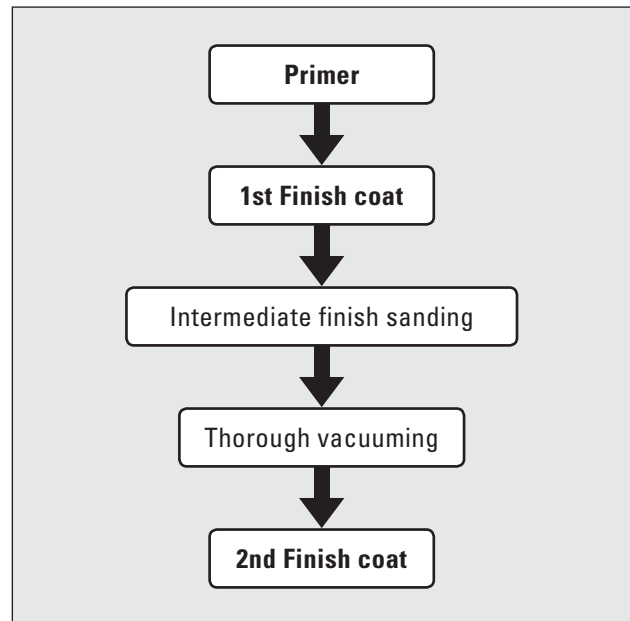


Fig. 33 Work steps when finishing **using a primer**.

Finishing without using a primer

Three finish coats are required if no primer is used. Instead of the primer, the first finish coat is applied and then the second and third finish coats. In this case, intermediate finish sanding is necessary following the first and second finish coats. The exact sequence of the work steps is shown in Fig. 34.

An additional intermediate finish sanding step can be carried out on heavily used wood flooring which was not primed before finishing. This is followed by an additional fourth finish coat.

It must be noted, that each additional finish coat increases the total thickness of the finish and causes the wood surface to lose a part of its natural appearance.

Finishing floor boards and strip flooring.

Finish should generally be applied to floor boards and strip flooring in the lengthwise direction, since the finish can otherwise collect in the joints or beveled edges. This leads to increased lateral bonding and thus to stresses in the wood flooring.

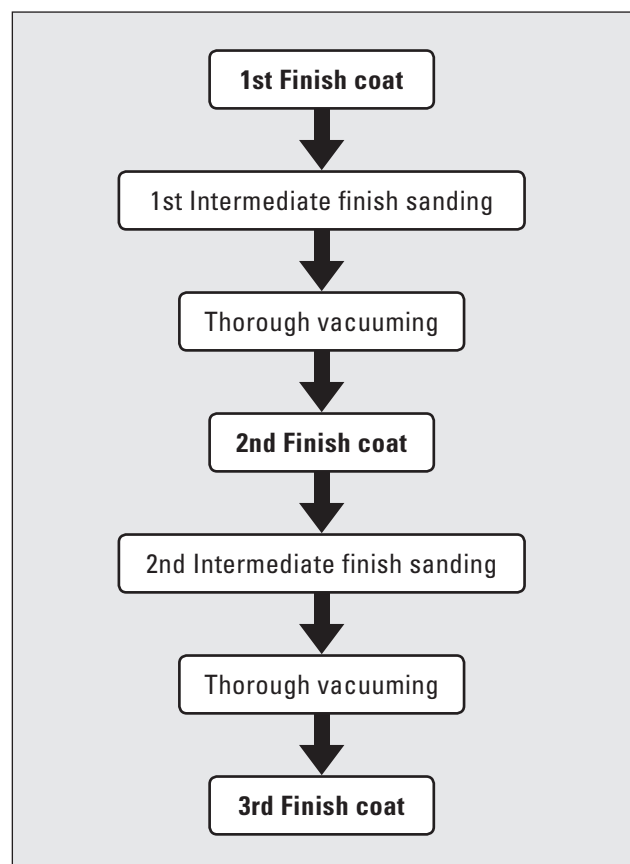


Fig. 34 Work steps when finishing **without using a primer**.

15.3 INTERMEDIATE FINISH SANDING USING THE TRIO OR THE SINGLE

The wood grains on the surface may become raised after the **first finish coat**. This makes the surface rough, it must be smoothed out by the intermediate finish sanding step. Both the TRIO three-disk sanding machine and the SINGLE single-disk sanding machine, each with sanding screen (generally using grits 100 to 150), are particularly suited for this. Sanding screen with driver pad are less aggressive than Velcro sanding disks. Since the surface only needs to be smoothed, the machine has to be moved quickly and at low sanding pressure (**without additional weight**).

The edge areas where the finish coating is not yet sanded following the usage of the TRIO or the SINGLE should be sanded manually with a sanding block or an orbital sander and only at **low pressure**.

The same sanding screen must be used for the intermediate sanding of the field and edges (**cutting material and grit**). Different degrees of roughness in the field and edges otherwise lead to differences in the brightness and thus to a visible transition from the field to the edge area of the finished flooring. Complaints can then not be avoided.

Care has to be given to ensure that the finish coat is not sanded through, since such points otherwise stand out as darker areas after additional finish coats.

The use of a used sanding screen is recommended to reduce the risk of sanding through the finish layer during intermediate finish sanding.

The wood flooring and the expansion gaps must be thoroughly vacuumed after every intermediate finish sanding step!

Airborne dust must be minimized otherwise it deposits on the freshly finished field and can lead to embedded dust / pimples.

Oiling and waxing of wooden floors

Oiling

When oils are used, they penetrate the wood flooring, saturate it and prevent penetration of other liquids. Since oil does not coat, the wood remains porous and thus appears more natural than finished or waxed wood flooring. The wood flooring can also be treated with colored oil instead of conventional oil to achieve a more unique appearance. The color pigments contained in the colored oil penetrate the wood when it is oiled and thus provide richer coloring of the wood flooring.

Waxing

Modern waxes frequently consist of an oil-wax emulsion. These are usually referred to as hard wax oils. Certain manufacturers also offer oils and waxes suited for a combination. For such combinations, the wood surface is first oiled and then treated with wax. The oil in this case ensures water-repellent impregnation and the wax forms a tough layer on the wood surface.

The following points must be considered before oiling or waxing:

- The wood flooring should not have any marks or damages.
- The field must be dry and free of contaminants such as oil, grease, wax, resin, cleaning agents, old coatings and substances containing silicone.
- Everything in the room (e.g. door frames, window sills, heaters, wood flooring, expansion gaps) must be thoroughly vacuumed immediately before oiling or waxing to minimize dust from depositing on the freshly treated surface.

Always follow the processing instructions in the data sheets of the oil and wax manufacturer (coating quantity, method, processing temperature, residence time, potlife, drying time, etc.)!

Oiling and waxing methods

It is recommended when oiling or waxing to begin around the edges.

Therefore, first use a small roller, trowel or paintbrush to oil / wax the areas around the heating pipes, door frames, corners and similar points.

Then use a roller, trowel or paintbrush to evenly apply the oil / wax to the remaining field, working towards the door. Try to work with the light so that you can observe your work and avoid unevenly applied oil / wax and missed spots.

Stir or shake the container regularly when processing colored oils to prevent the color pigment from depositing on the bottom of the container.

When the wood flooring has large joints or beveled edges and also in the case of floor boards, the oil / wax can collect in the joints or beveled edges and make them highly visible. The oil / wax is rolled only thinly on such wood flooring to prevent this.

After the coat is applied (note residence time, see manufacturer data) the oil / wax is rubbed into the wood surface with the **SINGLE single-disk sanding machine and a pad specified by the oil / wax manufacturer.**

The wood floor should not be used until the oiled or waxed surface is completely dry (observe the oil / wax manufacturer's data)!

The following points should be considered to prevent later complaints:

- The customer should be informed in advance about the options of modern oil / wax systems. The customer should be informed that minor flaws such as paintbrush hairs since they can never be completely avoided due to the conditions typically prevailing at construction sites.
- It is possible that the different wood absorbencies can lead to deviations in the brightness of individual elements.

Caring for wooden floors

Every wood floor is stressed by walking, shifting of tables and chairs, chair castors and household chemicals or other liquids. Routine care of the finished, oiled or waxed surface is therefore recommended to retain its protective function and the natural appearance of the wood for as long as possible.

Initial care

After the finished, oiled or waxed surface is finished, the company performing the work has to complete an initial care process. It is recommended to provide the customer with initial instructions on caring for the wood flooring and to give him / her a written copy of these instructions.

Care manual

The company performing the work should provide the customer with care instructions suited for the specific wood flooring. The company will otherwise be responsible for premature wear or damage to the finished, oiled or waxed surface due to improper care. The care instructions should contain the following information:

- Recommendations with suitable, currently available cleaning and care agents specified by product name. General care instructions are not sufficient here.
- Information on protective measures against damage to the finish, oil or wax surface (e.g. door mats or chair gliders).
- Information on the ideal room climate for the wood flooring.
- Information on timely follow-up treatment for the finished, oiled or waxed surface to prevent damage.

Room climate

A balanced room climate is required to ensure trouble-free usage of the wood flooring. The German "Chemical-technical working group for parquet finishing (CTA)" recommends a temperature of around 64 °F – 68 °F (18 °C – 20 °C) and a relative humidity of 50 % for wood flooring in this regard. When in doubt check with your supplier.

Routine care

The time intervals for routine care of the wood flooring depend on the wood species, the degree of exposure, and the type and amount of soiling. The wood flooring care instructions provide more detailed information about this topic.

Depending on the condition of the wood surface, light wiping, maintenance cleaning or a complete overall cleaning is performed. The SINGLE single-disk sanding machine or the TRIO three-disk sanding machine are equipped with suitable pads for this. The Velcro seal on the machine housing and the additional weight should be removed.

Large surfaces are divided into sub-surfaces to prevent the care agent from drying too fast. If a suitable mop is used in accordance with the manufacturer's specifications to apply the care agent to a sub-surface, it is then rubbed in by the machine. It is rubbed in manually around the edges.

Prevention of sanding marks

The required settings and maintenance on the machine are described in detail in the corresponding operating manuals!

18.1 GENERAL INFORMATION

- The wood flooring and expansion gaps or the staircases always should be thoroughly vacuumed **immediately before each** work step (every sanding step, gap filling or surface treatment).
- The abrasive must be suitable for the respective machine and should not be damaged.
- The abrasive must be correctly attached and fastened.
- The wheels should not be soiled or damaged.
- The V-belts should not be soiled, damaged or worn out.
- The pulleys should not be soiled, damaged or worn out.
- The machine operation must be uniform and adapted to the corresponding process.
- The grit sequence must be followed (see *Section 5.2, Correct choice of the grit sequence*).

18.2 DRUM AND BELT SANDING MACHINES

- The sanding pressure setting must match the abrasive grit to be used (also see *Section 7.3, Sanding pressure setting*).
- The side wheels must be set so that the sanding drum sands in the center.
- The lowering rod must move freely and not jam.
- The sanding drum should not be soiled or damaged.
- The tension roller of the assembly should not be soiled or damaged.
- The sanding drum must always be lifted from the floor before the machine is shut on or off.
- The sanding path displacement always has to be proceed from left to right (also see *Section 7.1, Method of operation*).
- The displacement from one sanding path to the next should not be too far out (also see *Section 7.2, Sanding path displacement*).
- The sanding direction must be selected to match the laying pattern of the wood flooring (also see *Section 8, Sanding directions using the HUMMEL® belt sanding machine*).
- Excessive pressure should not be exerted on the sanding drum during sanding. Please note the following points:
 - No additional weight should be placed on the machine.
 - The rear portion of the machine should not be lifted by the handle during sanding.
 - The lowering lever should not be pressed down during sanding.
- As soon as it is determined that the subfloor or wood flooring tends to vibrate, the sanding steps have to be executed as early as possible using the TRIO three-disk sanding machine instead of a drum or belt sanding machine.

18.3 EDGE SANDING MACHINES

- The wheel setting must be adjusted to the respective attachment.
- The two wheels must be set to an equal height.
- The sanding plate should not be set too steep. Otherwise digs can result.
- The sanding plates overlay has to be undamaged.
- The abrasive has to be firmly positioned in the center of the sanding plate.
- The machine always must be tipped slightly back so that the abrasive is lifted off the floor before it is switched on or off.
- The machine must always be guided with circular movements during sanding (also see *Section 10.2, Sanding method*).
- Excessive pressure should not be applied to the attachment during sanding.
- To increase the abrasion of the machine change the angle by adjusting the wheels.

18.4 TRIO THREE-DISK SANDING MACHINE

- The abrasives must be firmly positioned in the center of each sanding plate.
- The three sanding plates must be identically equipped.
- The sanding plates must be correctly installed and attached.
- The flexible Velcro rings should not be damaged.
- The flexible Velcro rings must be used with abrasives coarser than grit 60 (see *Section 11.1.3, TRIO processing plan for the PST® method*).

Visible sanding marks after surface treatment

19.1 ON FINISHED SURFACES

Brightness differences:

- The finish coat was accidentally sanded through at certain spots during the intermediate finishing sanding, which later leads to differences in the brightness on the completed finished surface (see *Section 15.3, Intermediate finish sanding using the TRIO or the SINGLE*).
- An abrasive with a different grit and cutting material was used for the edge sanding as for the previous field sanding. (see *Section 14, Final sanding step*).

Cloud formation:

Glossy spots can be seen on the surface (cloud formation). The same abrasive was used for too long in the last sanding step that it became too blunt. Excessively blunt abrasive burnishes the wood surface.

The wood absorbs less finish on burnished spots. This causes differences in the brightness.

The abrasive must be changed frequently enough to prevent burnished spots!

19.2 ON OILED SURFACES

Brightness differences:

- An abrasive with a different grit and cutting material was used for edge sanding as for the previous field sanding. (see *Section 14, Final sanding step*).

Visible sanding marks:

- The final sanding step was performed with an excessively coarse grit. Oiling requires finer sanding than finishing (see *Section 14, Final sanding step*).

Cloud formation:

Glossy spots can be seen on the surface (cloud formation). The same abrasive was used for too long in the last sanding step that it became too blunt. Excessively blunt abrasive burnishes the wood surface.

The wood absorbs less oil on burnished spots. This causes differences in the brightness, especially if colored oil is used.

The abrasive must be changed frequently enough to prevent burnished spots!

Hazard warnings

IMPORTANT:

Comply with your country's applicable regulations and directives!

The hazard and safety information applicable for your machine can be found in the corresponding operating manual! Read this carefully!

RISK OF FIRE due to spark formation when sanding or by spontaneous combustion:

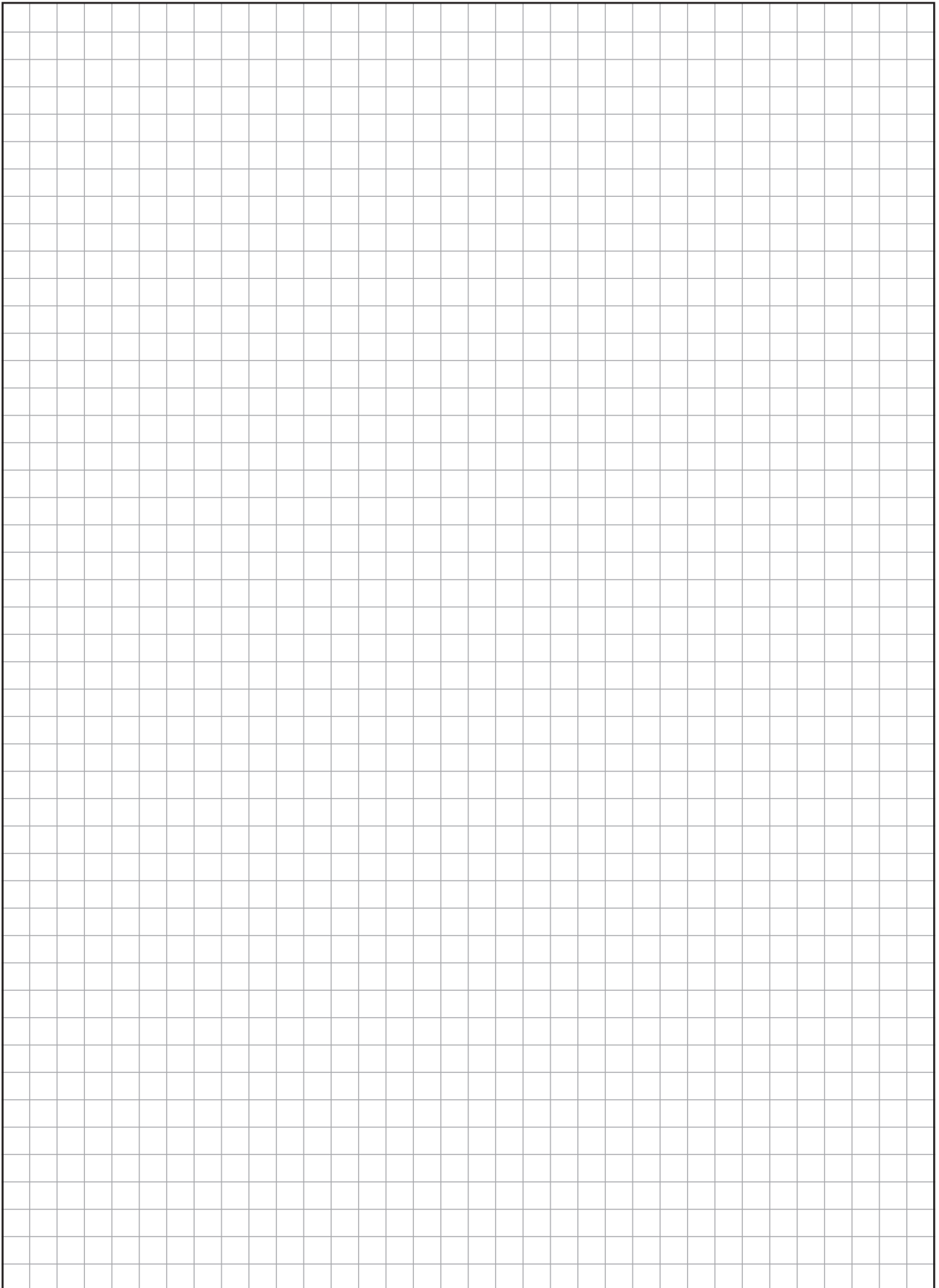
- Before sanding nailed or screwed wood flooring, the nails or screws must be countersunk deeply enough into the floor that they cannot be sanded.
 - Countersink nails, for example, with a hammer and drift punch!
 - Retighten the screws!
- Sanding wood with a high resin content, oiled or waxed wood flooring, or metal poses a particularly high fire hazard! Therefore the machines must always be cleaned thoroughly immediately after the floor treatment! Always observe the warnings of the finish, oil and wax manufacturers!
- Cloths, pads, etc., dipped in oil or wax can ignite independently! Always observe the warnings of the finish, oil and wax manufacturers!
- The dust bag must always be removed from the machine and emptied outdoors into a non-flammable container or stored in a non-flammable container! Close this container with a non-flammable cover and always store the container and dust bag outdoors!
- Always transport and store the machine without the dust bag or pouch!

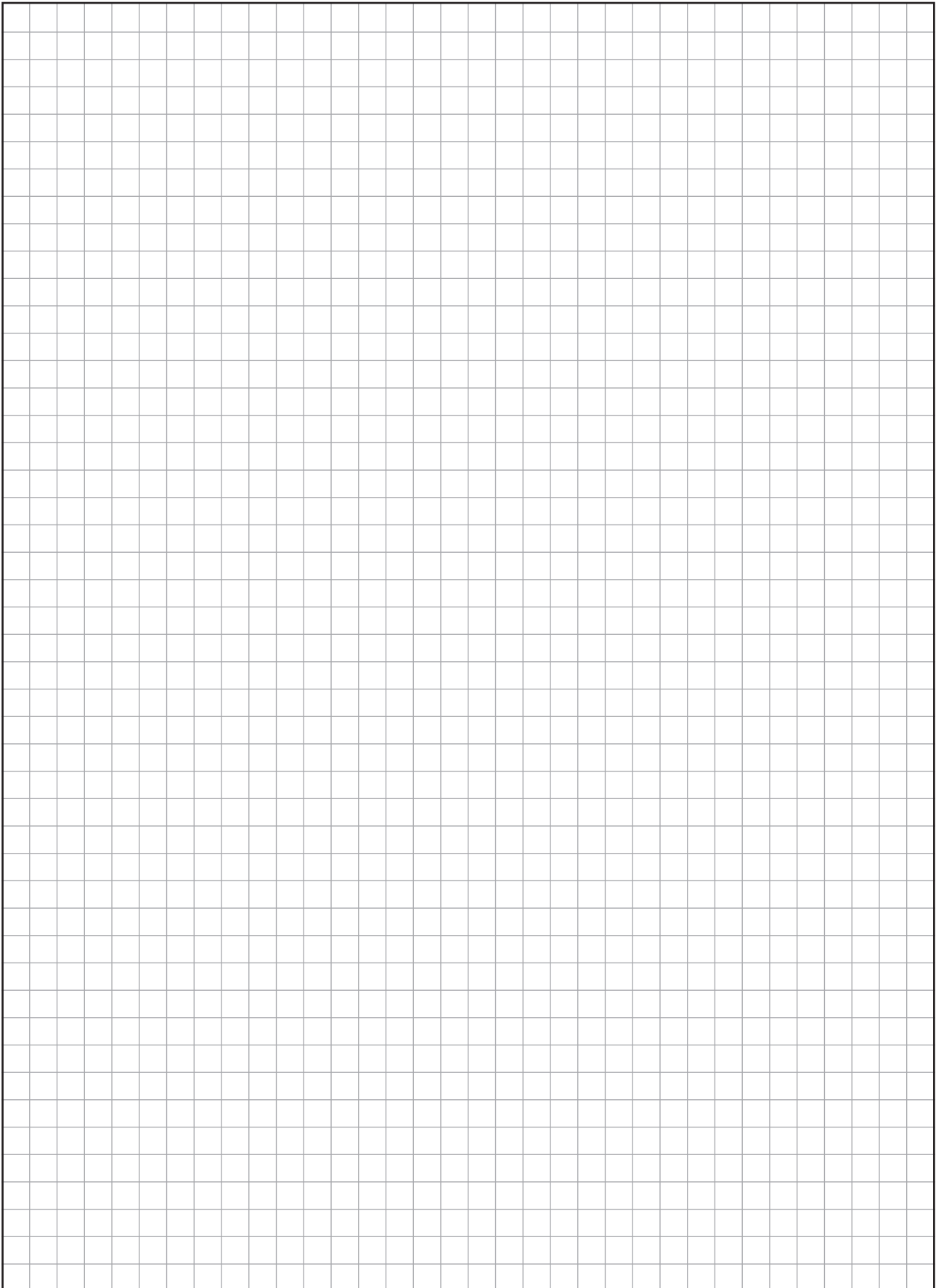
RISK OF EXPLOSION due to spark formation when sanding or excess dust concentration in the air:

- Do not use a machine in proximity with
 - Fire sources,
 - Flammable liquids or gases,
 - Explosive areas!
- Do not smoke in dusty surroundings, e.g. while sanding or emptying the dust bag!

HEALTH RISK due to dust:

- Please note the proper attachment of the dust bag / dust pouch!
- Respiratory protection (at least filter class P2) must be worn when emptying the dust bag outdoors!
- Wear respiratory protection (at least filter class P2) for all work generating dust, such as cleaning the machine!





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