



Gebauer & Griller Kabelwerke GmbH

STORING AND HANDLING MANUAL FOR AUTOMOTIVE WIRES



INDEX

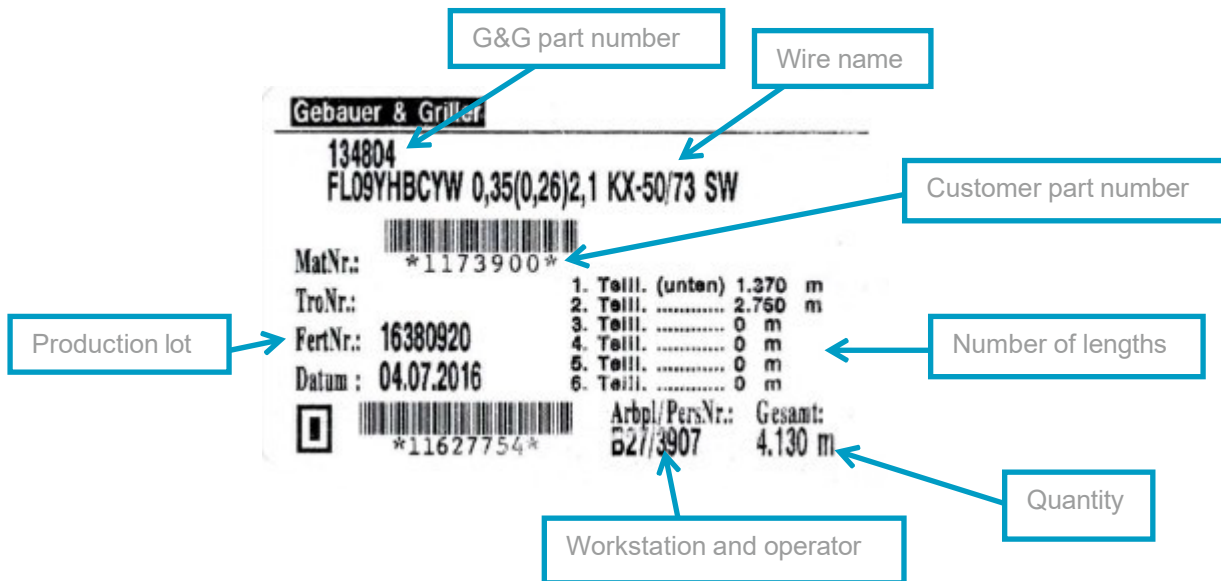
1.	Labelling and Packaging	2
1.1	Labelling	2
1.1.1	Production label.....	2
1.1.2	VDA4902 label	2
1.2	Packaging	3
1.3	Forms of supply	4
1.3.1	PS - Niehoff packaging system	4
1.3.2	Spool, wood drum	4
2.	Unloading and Transport	5
3.	Storage	7
4.	Unwinding	8
4.1	NPS packs	8
4.2	Straighteners	9
4.3	Cable pull-off.....	9
4.4	Spools	10
5.	Assembly	10
5.1	Assembly process remarks	10
5.2	Bending radius.....	11
6.	Packing return	12
7.	Contact	13

1. Labelling and Packaging

1.1 Labelling

Every package unit has two clearly placed labels.

1.1.1 Production label



1.1.2 VDA4902 label



1.2 Packaging

We use IPPC Euro-pool-pallets (standard and heat treated) 1200mm x 800mm according to “ISPM 15” standard, holding 2 – 6 spools (Fig. 1 and 2) at the same time.

The pallets with NPS are wrapped with plastic film to prevent slippage during transport. The NPS (Niehoff packaging systems) is the main packaging used for our single core wires for cross-sections 0.35mm² to 6.00mm².



Fig. 1 Pallet with six NPS



Fig. 2 Levels packaging

The Plywood spools are stored on Euro-pool-pallets (see Fig. 3) on their sides. They are fixed by strapping tapes.

2 - 4 plastic spools can be packaged on one pallet. Strapping tapes also fix them (Fig. 4).



Fig. 3. Plywood spool

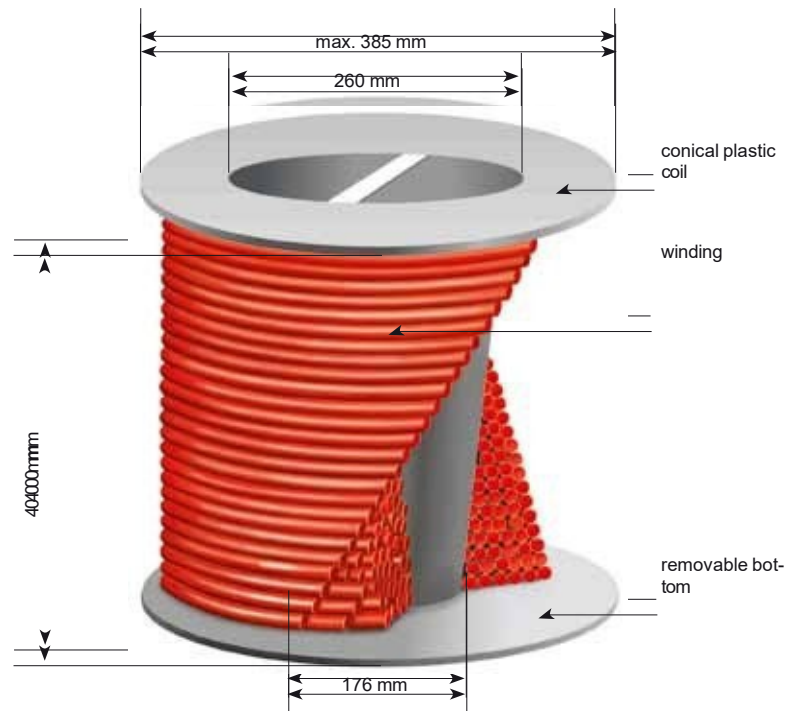


Fig. 4. Plastic spools

1.3 Forms of supply

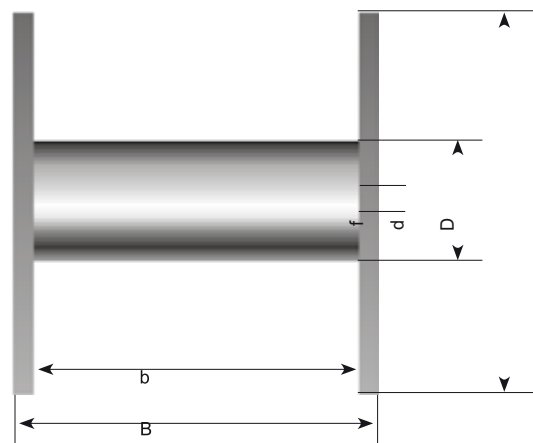
1.3.1 PS - Niehoff packaging system

- used for single core wires up to max. 6.00mm² nom. cross section
- 6 NPS- conic coils / pallet
- piling of NPS-spools for storage possible



1.3.2 Spool, wood drum

- used for single core wires with higher nom. cross sections or multicore cables



2. Unloading and Transport

For unloading and transportation of NPS a suitable device (see Fig 5) is needed. We recommend that the flanges are positioned horizontal (for NPS and plywood spools) during the transportation; this prevents rolling away of the spools.



Fig. 5 Lifting device

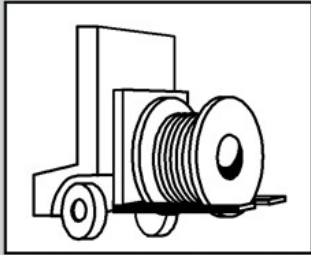
- Drums have to be stored upright (flanges are vertical), with stoppers to prevent from rolling.
- For transportation of the spools and drums, we recommend doing that by a fork lifter or crane, but do not lift the spools on the top flange because the cable or the reel may be damaged.
- When moving by crane please use a spreader bar to prevent bending the reel flanges and mashing the cable.
- If you use a forklift to move a pallet with spools, be sure that you do not drop any spool.
- For movement by hand (not with plywood spools, they have to be moved by fork lift), roll the reel or drum in the arrow direction of “roll” and only walk behind the drum never in front of it.



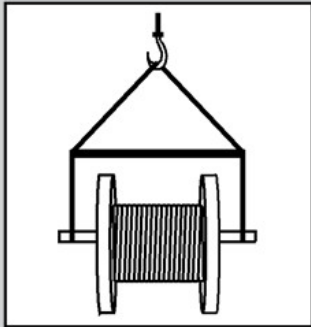
Fig. 6 Roll direction



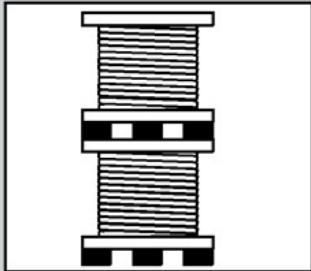
YES



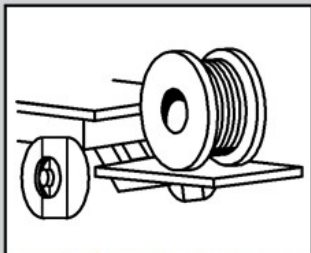
Cradle both reel flanges between forks.



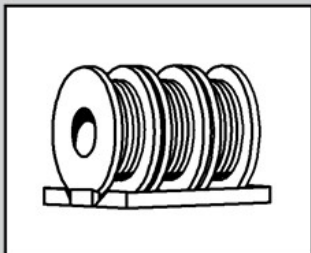
Reels can be hoisted with a shaft extended through both flanges.



Place spacers under the bottom flange and between reels to create a space to insert the forks.

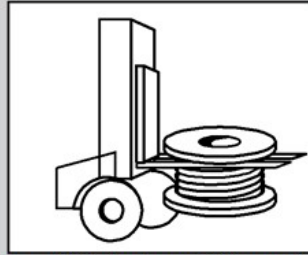


Lower reels from truck using hydraulic gate, hoist or fork lift. LOWER CAREFULLY.

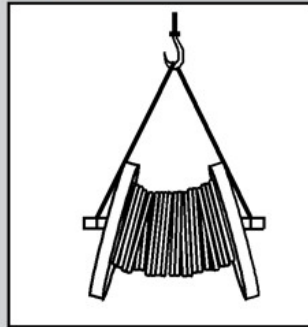


Always load with flanges on edge and chock and block securely.

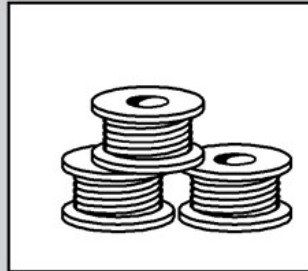
NO



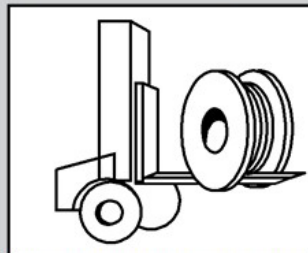
Do not lift by top flange. Cable or reel will be damaged.



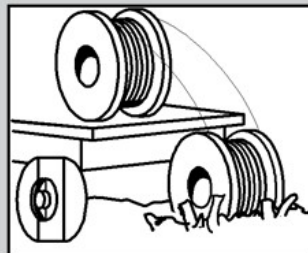
Use a spreader bar to prevent bending the reel flanges and mashing the cable.



Upended heavy reels will often arrive damaged. Refuse or receive subject to inspection for hidden damage.



Never allow forks to touch cable surface or reel wrap.



Never drop reels.

3. Storage

Drums and spools should be stored on a hard surface, secured against rolling away. Nothing shall touch the cable surface.

The cables should be stored in such a way that they are kept dry and save from any water (by condensation or rain). The storage duration can be reduced by any assembly process of the cable. White cables and wires must be protected from nitrogen oxides, as these can lead to discoloration of the surface in sufficient concentrations.

Optimum storing condition:

- Cables must be stored indoor at temperatures from -10°C to +60°C and relative humidity between 45% and 75%.
- Storing at these conditions has no significant impact to mechanical properties and thermal aging performance.

Optionally:

- Cables and wires on cable drums can be stored outdoor, when they are covered with a protective foil and the cable ends are protected by shrink-on cap.
- NPS drums are not recommended for outdoor storing.
- Wires stored outdoors MUST be conditioned indoor at room temperature for 24 hours before processing.

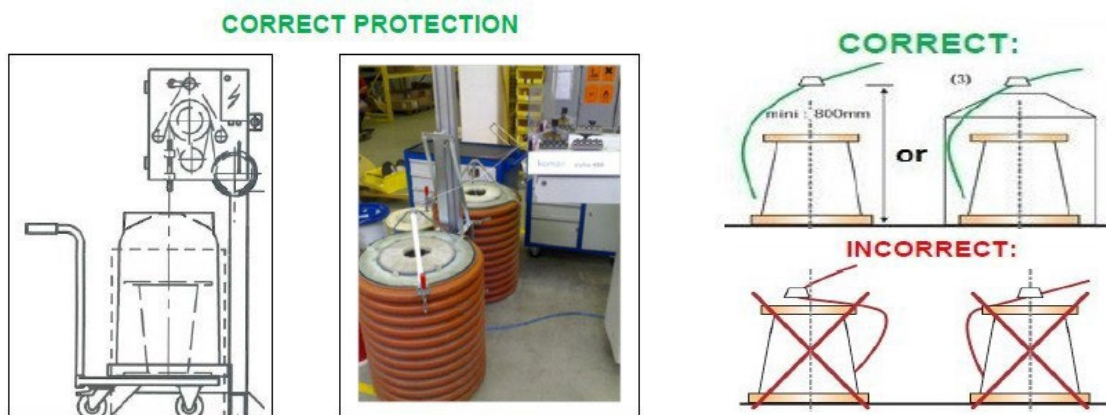
For the termination, process more severe storage limits may apply due to migration effects in the insulation and oxidation effects of the conductor.

- US weld ability of PVC insulated FLRY standard cables produced by GG has been proven after storage at a maximum temperature of 45°C for 3 months after production.
- Currently, there is no expertise available on US welding properties of other than standard PVC insulated standard cables. Thus, we cannot give validated storage recommendations in respect to these products.
- At higher storage temperatures in combination with long storage times, the US weld ability rapidly gets worse. Thus, in case of doubt we recommend US welding trial runs and a statistical analysis of the obtainable pull off forces before using older or special cables in series production.
- Copper forms an oxide layer at unprotected storage that may cause problems at crimping and soldering. The Insulation decelerates the oxidation of copper, so striped off cables should not be stored longer than 1 week before further processing.

4. Unwinding

4.1 NPS packs

Proper unwinding of the wires is very important to avoid any wire damage or blocking. According to the product of the winder system, the wire during the unwinding process should go free but with side protection to avoid getting damages or create some spiral loop effects.



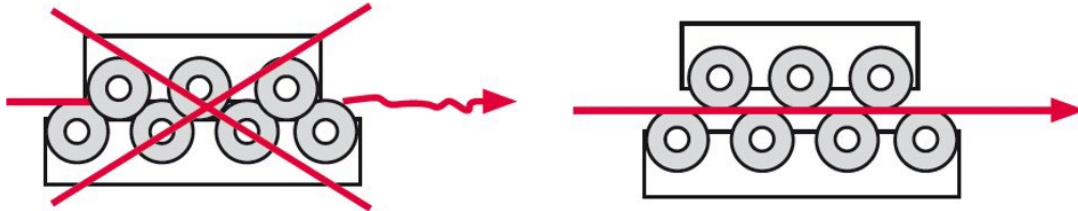
It should also be guided until the entrance of the machines, as close as possible, using tube, ceramic wire guides (no stainless steel), etc. The unwinding on the center of the conipacks should be done as shown in the following pictures:



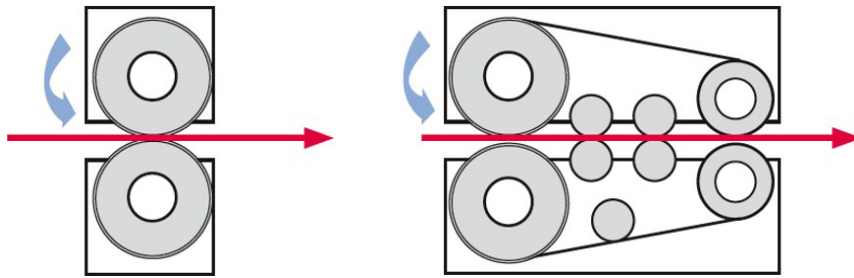
To avoid winding and loop problems when the cutting machines stop the wire must be tensioned. For proper use, it must be placed in appropriate unwinding equipment, which allows free movement of the wire and prevents it of hitting any obstacle (whip effect). Therefore, we propose to use a cover.

4.2 Straighteners

Straightening devices must be set in such a way that the cable's rollers are straight, but do not cause damage due to excessive pressure, which could, for instance, change the adhesion or the length of the insulation on a conductor.



The clamping force must be great enough to ensure the cable does not slip but must not damage it or alter its shape (oval). Care must be taken that the order of the single cores or of the conductor is not altered.



4.3 Cable pull-off

The stripping depth and the blade shape must be selected in such a way that the insulated coverings are cut without damaging the substructure (stranded conductor or twisted assembly). Processing must avoid distending / cupping of the insulated covering of individual wires or the single cores while stripping a multi-core cable.

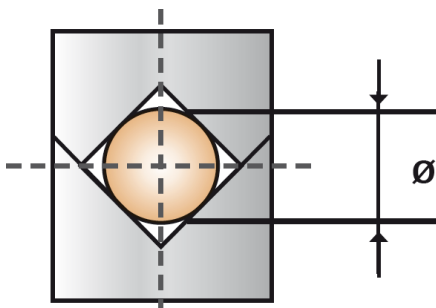


Fig. 7. Check of opening distance of the cutting/stripping blade

4.4 Spools

For bigger cross-sections $>10\text{mm}^2$ the use of motorized pay-off is recommended to avoid winding issues.

CORRECT:



INCORRECT:



5. Assembly

5.1 Assembly process remarks

When selecting the contacting method, the construction of the cable must be taken into account so that there are no restrictions on the cable properties. A too long dwell time in the solder bath can, -for example- lead to shrinkage of the insulation. The contact area on the cable lug must be free of oil, grease, dust and flat chips, as these can have a negative effect on the connection between the contact and the conductor. The contact must not have any damage that could damage the cable (both conductor and insulation) and adversely affect the connection.

The contact geometry must be adjusted so that neither the individual wires nor the insulation is damaged.

To counteract possible contact corrosion, contact materials with a standard potential E similar to the conductor must be used. In addition, the connection surface must be kept free from media that promote corrosion.

The conductor must be kept clean during handling, storage, and processing, i.e., contamination by foreign materials such as metal dust must be avoided.

The welding parameters depend on the surface cleanliness and the material properties of the parts to be connected. Correct dimensioning of the welding machine and optimal maintenance condition of the tools must be ensured. The welding parameters have to be adapted to the contact part and system properties. Different strand constructions (even with the same conductor cross-section) must also be taken into account when determining the welding parameters. This applies if different conductor constructions, conductor materials and/or conductor cross-sections as well as different insulation materials are to be combined.

Standard parameter sets from equipment manufacturers can only serve as a guide but must be based on the parts to be processed. Due to technically unavoidable batch fluctuations, it may be necessary to adjust the processing parameters depending on the delivered batch.

When soldering, care must be taken to ensure that no solder from the contact zone penetrates further into the inside of the cable (e.g., through capillary effects), as this will impair the cable properties.

The following applies to special cables: In order to maintain the electrical properties of the cables and specially to ensure good crosstalk attenuation, the cable pairs or star quads should unnecessarily not be twisted or untwisted. With shielded cables, the shielding must extend as far as possible into the connector in order not to reduce the EMC properties.

5.2 Bending radius

The inner bending radius must be considered to rule out damage to the cable while flexing. The identified radius is determined by a multiple of the outer diameter. The stated values apply only for cables in fixed installations.

The minimum permissible bending radius for cables used in constantly flexed operations must be determined on a case-by-case basis. Particularly in the case of special cables, such as data transmission cables, there will be an individual specification to ensure the special cable properties at all times.

The following parameters must be observed per cable type during cable assembly:

Cable type	Minimum permissible bending radius (mm)	
	One-off bend D = diameter	Repeated bending (max. 10 bends), D = diameter
Single-core cables (FL..., FLR...) nominal cross section $\leq 6,0 \text{ mm}^2$	2 x D	6 x D
Single-core cables (FL..., FLR...) nominal cross section $> 6,0 \text{ mm}^2$	3 x D	10 x D
Twisted, multi-core cables (without jacket)	5 x D	15 x D
Multi-core, unshielded and shielded sheathed cable		
Version with standard strand A or B	5 x D	15 x D
Version with high-flex strand (e.g. single wire diameter of 0.5 mm^2 : max. 0.16 mm)	3 x D	10 x D
Flat cable version with D = width x thickness	5 x D	15 x D

6. Packing return

The empty NPS has to be taken apart by unlocking the top flange and open it.

The opened NPS can then be stapled on other NPSs in order to minimize the storage volume.

The stacks can be stored on euro-pool pallets and should be protected by wrapping a plastic film around it to prevent slippage during transport.



7. Contact

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