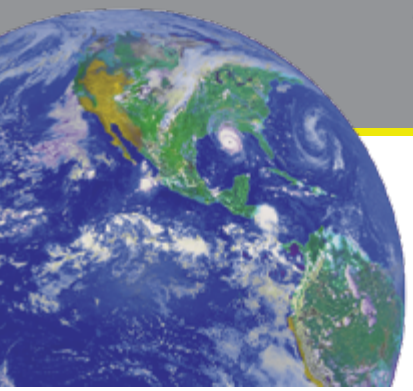
MERKUR®
POWER DISTRIBUTION

Induo® Pole-System



MERKUR®
GERMAN TECHNOLOGY

Content

Induo® Pole-System

Ulrich Scheller
Export Manager

For over 100 years – since the time of Werner von Siemens – German Technology is renown for outstanding innovation and technical leadership. **MERKUR®** Ueberseehandel GmbH is committed to this long tradition.

Under **MERKUR®** German Technology we develop and produce warranted , durable high quality products in the following segments:

- Electrotechnology
- DUPROLUX® Lighting
- Metering
- Power Distribution
- Climatisation
- Renewable Energy

MERKUR® clients worldwide can rely on our vast experience. We offer authorised distributors competitive prices better allowing them to compete in the market. We also successfully cooperate with contractors who are bidding for public utility tenders.

MERKUR® is a reliable partner with a tradition of providing individually tailored products and solutions in accordance with customers' needs. Contact us and we gladly assist you with more details about our products and services. Get in touch with us!

Export Manager

Induo® Utility Pole-Systems

The advantages of both induo® Utility Pole Systemsat a glance

Our ambition is to guarantee safe electricity supply with induo® Wood Poles and induo® Engineered Timber Poles and to contribute permanently to the qualification and standardization of European medium and low voltage electricity networks. Therefore we have developed pole-systems, which consist of groundwork, pole, cross beam and all appropriate connection instruments.

induo® Engineered Timber Poles:

- Patent-registered pole-system made of high strength and entirely waterproof wood veneer layer-material and induo® anchor-system.
- Environmental-friendly because of positive carbon monoxide outcome.
- High carrying capacity and high span width.
- Pole distances and cross sections are not limited in height of natural tree growth.
- Long service life due to special pressure im pregnation procedure for cross sections and whole poles.
- Little maintenance required / poles are ac cessible with common climbing belt systems.
- Lower priced than conventional poles made of steel or concrete.
- Compatible to all established cross arm systems and all kinds of wiring.
- Realizable with low-price soil groundwork or classical concrete groundwork.
- Can be attached on existing groundwork.

induo® Engineered Timber Poles:

- Patent-Patent-registered pole-system made of rounded wood of defined stability and growth characteristics and induo® anchor-system.
- Wood poles are renewable raw materials with high regional availability.
- Wood poles are a low-price and effective way of constructing overhead wirings.
- Light-weighted and therefore easy to handle.
- Easy to transport and assemble.
- Wood poles have high carrier capacities and are very flexible.
- Standard wood poles do without complex groundwork constructions.
- Wood poles fit well into the landscape.

Induo® Engineered Timber Poles

The new, powerful generation of pole-systems made of high-strength engineered wood products

The cost-effectiveness of overhead lines is based on safe operation, long service life and high productivity of pole systems with different functions and of different constructions. induo® Engineered Timber Poles offer fundamental technical and economic advantages to steel and concrete poles but an at least equally long service life. As you can choose the pole heights and get very high carrying capacities, the induo® Engineered Timber Poles are an alternative to wood poles made of one piece, which are limited in height by the natural growth size of trees and thus limited in carrying capacity - therefore cannot be used for every grid facility.

The new powerful generation of pole systems is made of high-strength entirely waterproof wood veneer-layers, licensed by the building inspection. This material has successfully been used for the last decades for constructions of statically high-freight loads, for bridge and hall building and weather-pressurized surfaces such as roofs and store fronts. The induo® Engineered Timber Poles fulfill all requirements put on the construction of overhead lines which among others arise from the energy turnaround and increasing environmental influences:

- Pole lengths 7.00 – 20.00 m for all voltage ranges (LV, MV, HV)
- About 50 years of service life due to entirely waterproof impregnation of profiles or alternative foundation with precast concrete component.
- Low lifecycle costs, less checking and maiten ance costs by longer control cycles.
- induo® Engineered Timber Poles meet all normative and building legislation requirments.
- induo® Engineered Timber Poles are in accordance with the Conservations of Wild Birds Directive.
- Economic realization of overhead lines with aerial cables for wind span widths up to 200 m as alternative to expensive underground cable construction.
- induo® Engineered Timber Poles are a low-priced alternative to steel and concrete poles and at the same time offer larger field span width and are realizable as angle and terminal tower poles.

Induo® Engineered Timber Poles

Delivery programme suspension poles -

induo® Engineered Timber Poles

Standard suspension poles for operation of medium and low voltage.
Characteristic load capacity of up to 6.0 kN in wind zones I + II.
Standard with identical head design for standardized cross arm connection.

Standard suspension poles with a typical permitted load of 6 - 7 kN

Pole type	Pole length (m)	Embed-ment depth (m)	Head height above ground level (m)
iTP 10	10	2	8
iTP 11	11	2	9
iTP 12	12	2	10
iTP 13	13	2	11
iTP 14	14	2	12
iTP 15	15	2.5	12.5
iTP 16	16	2.5	13.5
iTP 17	17	2.5	14.5

Standard suspension poles with a typical permitted load of 3 - 4 kN

Pole type	Pole length (m)	Embed-ment depth (m)	Head height above ground level (m)
iTP HE 8	8	1.6	6.4
iTP HE 9	9	1.6	7.4
iTP HE10	10	1.7	8.3
iTP HE11	11	1.8	9.2
iTP HE12	12	2	10.0
iTP HE13	13	2.2	10.8
iTP HE14	14	2.3	11.7
iTP HE15	15	2.5	12.5

Application spectrum

The induo® Engineered Timber Poles offer a wide application spectrum for low and medium voltage. E.g. for wind span widths of up to 200m, with soil footing or precast concrete component, they fulfill the typical functions of cable wiring.

Footing with straight soil foundation and with precast concrete component

Induo® Engineered Timber Poles

Replacement and renewal of poles

Reliable after installation

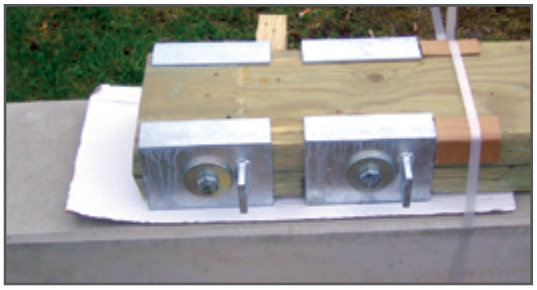
The replacement and reconstruction of poles and wiring often is linked to the existing transmission system of the overhead line, which consists of foundation, pole, cross-arm and mounting brackets. These differ broadly in their construction due to the formerly numerous number of regional and national network owners. The induo® Engineered Timber Poles ensure low cost standardization of stock keepings and logistics and are adjusted in design and construction to these requirements.

Existing cross arms and conductor rope mounting brackets

In case a re-use of existing cross-arms is possible, it saves, above all, time for assembly and costs. Existing cross-arms are generally attachable without any alteration works. The induo® Engineered Timber Poles in their head design can be adjusted to different systems and measurements. If the delivery of new induo® cross-arms is necessary due to reasons to do with the wiring or static requirements, we directly consider the connections of the particular cross-arms and isolators.

- Re-use of existing cross-arms with standardized induo® connection, fitting all cross-beam systems.
- Alternatively: low-cost cross-arm system made of high-strength engineered wood products, alternatively conventional steel cross arms according to customer`s choice for any conductor rope lead.
- Available also as ready-for-assembly set, consisting of isolators, cross-beams, pole and footing.

Induo® Engineered Timber Poles



Transport and assembly of poles

Well-thought-out from the beginning to the end

The delivery of the induo® Engineered Timber Poles is carried out ready-for-assembly including all connection instruments, needed junction and mounting parts.

The assembly can be carried out with simple and commercial assembly devices. For the completion only simple and available tools are needed from the electronic or mounting company or the company-owned maintenance facility.

Due to their low dead weight in comparison with steel or concrete poles,induo® Engineered Timber Poles are simple and cost-effective to transport and assemble. In difficult terrain and/or in environmental conservation areas, separate and expensive delivery and unloading orcost-intensive crane works and approval procedures.

- Low transport and assembly costs through significantly lower weight of poles compared to steel and concrete poles.
- Economic soil footing, alternatively footing on existing foundations or with precast concrete components by induo® anchor engineering.
- Easy mounting and control during the subsequent maintenance of wiring.

Induo® Engineered Timber Poles

Delivery programme angle bracket, angle span and terminal poles

induo® Engineered Timber Poles

Angle bracket and angle span poles form the carrying element of any overhead line, e.g. when it crosses streets, rivers or barriers and motorways, the also serve as bending or securing elements in the wiring line.

Low voltage

For the construction of angle bracket, angle span- and terminal poles in low voltage the same profiles of the standard suspension poles of the induo® Engineered Timber Pole-Systems are produced. (See: delivery programme page 6)

With a soil or precast concrete foundation, steel and concrete poles in low voltage, which need to be refurbished, can easily be replaced at a low cost. Also, cables coming out or going into the soil can easily be installed.

Medium voltage

The induo® Engineered Timber Pole-System offers also highly loadable angle bracket, angle span and terminal poles for medium voltage. In order to reach the most possible cost efficiency these pole types are individually selected for their place of installation. For the selection and sizing of the respective poles we need the following information:

- Type of mounting bracket
- Place of installation
- Field span width

You receive an offer for the delivery of your desired ready-for-assembly angle bracket or terminal poles from us or our qualified and certified competence partner of the wood pole industry.

Pole foot with soil foundation after 20 years of installation

Induo® Engineered Timber Poles

High voltage poles and special constructions

Planning, engineering and completion

Grand safety regulations and strict normative requirements also apply to overhead lines and their components at high voltage level. We offer individual and custom-tailored solutions out of the delivery programme of the induo® pole-systems for the development and installation of these constructions. During the carrying-out of the project we are happy to attend you with our holistic planning and engineering services.

- Analysis of appraisal / preliminary inspection and location planning
- Selection or draft, sizing and completion of the respective overhead system and poles
- Static measuring and certification of the systems and components through our experienced engineers
- Alternatively development, carrying-out and construction of special solutions
- Completion and factory planning, production supervision
- Delivery of ready-for-assembly poles by our l icense holders
- Acceptance and implementing with subsequent quality management

Induo® Engineered Timber Poles

Production and quality control – induo® Engineered Timber Poles

Secured quality

induo® Engineered Timber Poles are produced out of single ayers of merely 3 mm thick peeled wood veneers of spruce and pine trees. The veneers of selected rounded timber stubs of about 1,20 m length are peeled as longrugs by holding the turning stub into the peeling knife..

Unending lenght

The veneers are lengthwise separated into parts as long as the finished panel should be in the end, then they are desiccated. The wood fibers now exactly run parallel to the longitudinal direction of the panel. The longitudinal sides are milled with an angle before they are glued; that way mounting joints are formed between the veneer layers which allow the production of endless panels.

Profiles of inherently stable sizes

The veneers receive a weather-proof cement and are compressed to panels. The thickness of the panel is reached by the desired number of layers until the appropriate diameter is reached. The complete panel is produced in a through-feed- method as ”endless” length and is later cut into the needed pole size lengths before delivery.

Tested

The complete diameter size of the induo® Engineered Timber Poles is entirely waterproof impregnated in a boiler pressure procedure. The industrial production process and the complete and entire impregnation guarantee a highly load-bearing and multi-functionally resilient production of induo® Engineered Timber Poles.

Induo® Engineered Timber Poles

Certification, guarantee and ecology

induo® Engineered Timber Poles

Central and Northern European conifers are the basic raw material for the induo® Engineered Timber Poles. Since prehistoric times timber has been the most often and miscellaneously used raw material.

In Germany alone the forest with about 11 million ha accounts for almost one third of the size of the country. Other renewable materials grow in Germany on two million ha land (about 17 per cent of German agricult ral crop land). Within the whole timber wood industry more than one million people are employed generating an annual turnover of over 100 billion Euros.

Positive carbon footprint

Wood detracts more carbon monoxide out of the atmosphere during its growth than is released during the processing of timber. In addition, the forest cleans the air, secures drinking water reserves and offers people and animals cover, life space and relaxation.

■ **Storage of carbon monoxide during the growth of the tree**	**> + 825 kg CO2 / m³**
■ **Felling and transport from forest to production plant**	**- 21 kg CO2 / m³**
■ **Production energy for completion of poles**	**- 87 kg CO2 / m³**
■ **Pole transport and assembly**	**- x kg CO2 / m³**
CO2 Bilanz:	**> +500 kg CO2 / m³**

Induo® Engineered Timber Poles

Approval

The induo® Engineered Timber Poles have been developed according to the standards of German energy suppliers and DIN-standards. The existing European and international norms put very high standards on the reliability, operational safety, service life, quality safety and ecological harmlessness of the production of today`s overhead lines.

Induo® Engineered Timber Poles have in their design been approved by the building inspection and in its entirety fulfill the requirements of the State Building Code.

In addition, we guarantee compliance of our products to the European Building Products Guideline. Together with associations, universities, production companies and, above all, our customers, we aspire a constant enhancement of the quality, customer satisfaction and cost efficiency of our solutions and products.

Induo® Wood Poles

Induo® Poles Wood Poles

induo® Wood Poles

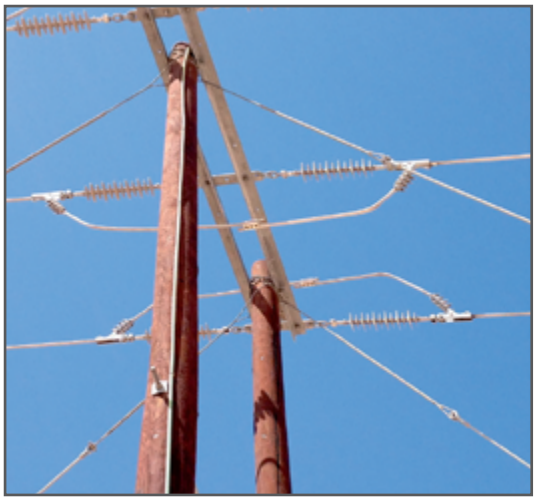
Overhead lines referring to DIN EN 50423

The transitional period for the parallel use of the new standard and the predecessor standard VDE 0210 expired already end of September 2007. The major difference between both standards is the completely new security concept as was already implemented for the European-wide construction industry in the mid-eighties of the last century.

A number of traditional artisan-based methods for the production of wooden pole connections are no longer traceable according to the latest standards. In a joint effort with the members of the German Woodpole Association and leading power supply companies we have developed transition structures and combined them to pole systems.

Taking into consideration the swelling and shrinking behavior of wood, the system solutions meet all requirements according to the latest standardization concept. All connections are verified by static – from the cross beam and the connectors up to the pole and the groundwork.

Induo® Round Wood Poles



Round Wood Poles

For power industry and telecommunications

We supply our worldwide customers from the telecommunication and power industries with impregnated and ready for assembly round wood poles of various specifications and types.

For our export customers these are above all, Rüping impregnated creosote poles in accordance with British Standard growth, grading and impregnation regulations for the specifications of each individual country. Through a special Rüping vacuum pressure procedure, the minimum amount of 95 - 140 kg per m3 of WEI type “B” or “C” protective agent is impregnated into the entire sapwood area. For quality reasons we principally supply pine poles, which due to their wood and growth characteristics, are especially suitable for use. These characteristics ensure good impregnability. Round would spruce poles are only supplied on customer demand.

Product range Round Wood Poles

Light Poles in accordance with British Standard BS 1990: Part1: 1984 / Length 7 - 16 m

Pole type Nominal Size	Pole length l (m)	Food-ø f_{min} (mm)	Top end-ø $_{min.-max.}$ (mm)
6.0 m light	6	150	125-150
7.0 m light	7	160	125-150
8.0 m light	8	170	125-150
8.5 m light	8.5	180	125-150
9.0 m light	9	180	125-150
9.5 m light	9.5	185	125-160
10.0 m light	10	185	125-160
10.5 m light	10.5	190	125-160
11.0 m light	11	195	125-160
11.5 m light	11.5	200	125-165
12.0 m light	12	200	125-165
13.0 m light	13	210	125-170

Induo® Round Wood Poles

Product range Round Wood Poles

Medium Poles in accordance with British Standard BS 1990: Part1: 1984 / Length 7 - 16 m

Pole type Nominal Size	Pole length l (m)	Food-ø f_{min} (mm)	Top end-ø $_{min.-max.}$ (mm)
7.0 m medium	7	200	140-170
8.0 m medium	8	210	145-180
8.5 m medium	8.5	215	150-180
9.0 m medium	9	220	150-180
9.5 m medium	9.5	225	150-180
10.0 m medium	10	230	150-185
10.5 m medium	10.5	235	150-190
11.0 m medium	11	240	150-190
11.5 m medium	11.5	245	150-190
12.0 m medium	12	250	150-190
13.0 m medium	13	260	160-200
14.0 m medium	14	275	160-205
15.0 m medium	15	290	165-210
16.0 m medium	16	305	170-215

Product range Round Wood Poles

Stout Poles in accordance with British Standard BS 1990: Part1: 1984 / Length 8.5 - 16 m

Pole type Nominal Size	Pole length l (m)	Food-ø f_{min} (mm)	Top end-ø $_{min.-max.}$ (mm)
8.5 m stout	8.5	270	190-240
9.0 m stout	9	275	190-240
9.5 m stout	9.5	280	190-245
10.0 m stout	10	285	190-245
10.5 m stout	10.5	290	190-250
11.0 m stout	11	295	190-250
11.5 m stout	11.5	300	190-250
12.0 m stout	12	305	190-250
13.0 m stout	13	320	195-255
14.0 m stout	14	335	195-255
15.0 m stout	15	350	195-260
16.0 m stout	16	365	200-265

Induo® Wood Suspension Poles

Suspension poles medium voltage

induo® Wood Poles

Suspension poles of the induo® Wood Pole-System today already are a standard for medium voltage aerial-lines of many regional network operators and large energy suppliers. The system comprises the regionally different cross arm and wiring constructions, fitting to:

- Cross beams with one- or several level mounting brackets
- Hanging or supporting isolator construction method
- Conductor rope connections without cross arms

We deliver ready-for-assembly and quality proofed suspension poles – as a system – inclding all necessary connection instruments and required component parts. Delivery as a system, fitting for a re-use of old existing cross-arms or as complete set including new cross beams and isolators.

The completion is carried out as the always identical induo®-typical head design. Thus the loads of the cross beam or from the conductor ropes are discharged at the crosssection of the poles. A splitting of the wood due to possible torsion exposure is therefore – because of the production material – safely prevented. The induo® anchor connection to the cross arm is a steel contact. The contact to the wood is a permanent timber joint and bolting.

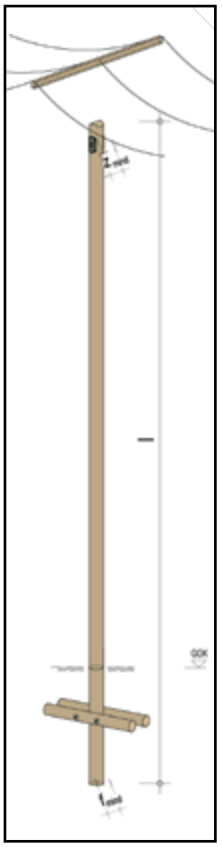
The wood pole is the most cost efficient construction for overhead wires, it is:

- regional available
- fitting into the landscape
- easy to supply
- low-cost in purchase
- fast and uncomplicated in assembly
- durable and easy to replace
- easy to maintain and to mount
- and always renewable!

Induo® Wood Suspension Poles

Delivery programme suspension poles
induo® Wood Poles

Standard suspension poles for the installation for medium and low voltage
Characteristic carrying capacity of up to 3.5 kN in wind zone I and 3.3 kN in wind zone II
As standard with identical head design for homogeneous cross beam connection



Short mark	head height above ground m	pole length l m	food-Ø f_{mind} cm	top end-Ø z_{mind} cm	tensile load N_K windzone 1 / windzone 2	
1022	8.3	10	21-23	15-17	1.8 KN	1.8 KN
1025	8.3	10	24-26	18-20	2.8 KN	2.7 KN
1123	9.2	11	22-24	15-17	1.9 KN	1.8 KN
1127	9.2	11	26-28	19-21	3.2 KN	3.1 KN
1224	10.0	12	23-25	15-17	1.9 KN	1.8 KN
1229	10.0	12	28-30	20-22	3.5 KN	3.4 KN
1326	11.0	13	25-27	17-19	2.2 KN	2.1 KN
1329	11.0	13	28-30	20-22	3.2 KN	3.0 KN
1426	12.0	14	25-27	16-18	1.9 KN	1.8 KN
1430	12.0	14	29-31	20-22	3.1 KN	3.0 KN
1531	13.0	15	30-32	20-22	3.2 KN	3.0 KN
1633	13.0	16	32-34	21-23	3.5 KN	3.3 KN

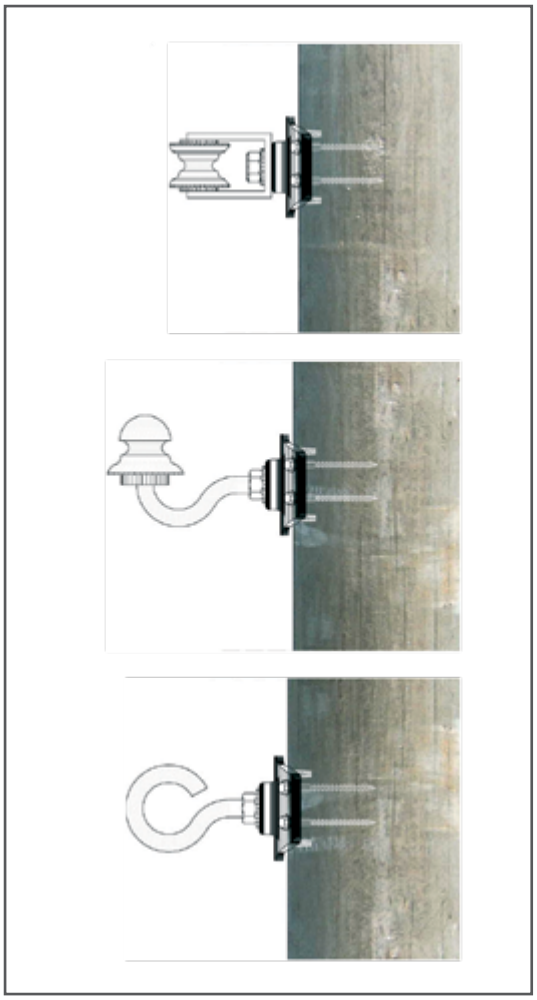
Carrying capacity of induo® single suspension poles

induo® single suspension poles can be strained with the following tensile load at pole head. Ground clearance at profile change, pole lengths and footing diameters has to be checked depending on the chosen rope diameter and span widths.

The tensile load is the horizontally highest allowed overall tension force at the pole head, already reduced by the wind load on the pole head. For the calculation of the tensile load power we used respectively the medium pole type/diameter. The tensile load power was calculated following DIN EN 50423/12.07.

For the demonstration of the pole footing the shown construction with an acceptable foundation pressure up to 1.5 m depth of 300 kN/m² was calculated. At ground conditions with higher acceptable foundation pressures or very short span fields, the wood pole can be mounted without sole piece/wind piece.

Induo® Wood Suspension Poles



Suspension poles low voltage

induo® Wood Poles

Due to increased loads on overhead lines at low voltage level, a safe and standardized construction of conductor rope connections with the induo® Wood Pole System is recommended.

The wood poles are for this purpose pre-drilled at the production plant or alternatively through the mounting company on the installation site. Into the always identical setting of the induo® typical-drills the fitting induo® anchors are mounted with four-way couplings. Thus, every pole can be used either for low or medium voltage, you only change the induo® connection part.

- Standardised connection appearance at pole
- Always identical and quality-proofed pole setting
- Fitting and standardised connection instruments for shackle bail, beam insulations, ISO- and terminal span hooks

Induo® Wood Twin Poles

Twin Poles Medium and low voltage

induo® Wood Poles

Twin poles of the induo® Wood Pole-System are composed out of two conventional induo® suspension poles. The connection, connection instruments and cross arm constructions stay unaltered and are built the same as for the carrying pole. Four additional angles brackets connect the poles at the head and make possible - from the constructional side - the mounting of two induo® suspension poles to one highly load-bearing twin pole.

The load discharge occurs - appropriate for the material – through the patent-registered induo® steel-steel connection. Due to the simultaneous discharge of load of the conductor tensile powers into both poles and because of the larger foundation area in the soil, the induo® wood twin pole carries twice the load of a single pole.

- The combination of two induo® suspension poles makes a twin pole
- Identical connection instruments, identical cross arms, low additional costs
- Double load bearing capacity

Short mark	head height above ground m	pole length l m	food-Ø f_{mind} cm	top end-Ø z_{mind} cm	tensile load N_K windzone 1 / windzone 2	
2x 1022	8.3	10	21-23	15-17	3.6 KN	3.6 KN
2x 1025	8.3	10	24-26	18-20	5.6 KN	5.4 KN
2x 1123	9.2	11	22-24	15-17	3.8 KN	3.6 KN
2x 1127	9.2	11	26-28	19-21	6.4 KN	6.2 KN
2x 1224	10.0	12	23-25	15-17	3.8 KN	3.6 KN
2x 1229	10.0	12	28-30	20-22	7.0 KN	6.8 KN
2x 1326	11.0	13	25-27	17-19	4.4 KN	4.2 KN
2x1329	11.0	13	28-30	20-22	6.4 KN	6.0 KN
2x 1426	12.0	14	25-27	16-18	3.8 KN	3.6 KN
2x 1430	12.0	14	29-31	20-22	6.2 KN	6.0 KN
2x 1531	13.0	15	30-32	20-22	6.4 KN	6.0 KN
2x1633	13.0	16	32-34	21-23	7.0 KN	6.6 KN

Ground clearance at profile change, pole lengths and footing diameters have to be checked depending on the chosen rope diameter and span widths.

Induo® Wood A Poles

Terminal Pole Medium / low voltage

induo® Wood Poles

Terminal and dead-end towers stabilize the wiring and form the carrying and securing element of an overhead line. At medium and low voltage lines, the construction of A poles is standardized by the induo® Wood Pole-System and becomes statical predictable. We deliver a ready-for-assembly A pole including all connection instruments, and, if you wish, with appropriate cross arm. Already before delivery the producer seizes the wood and the appropriate system connection. This is carried out quality-proofed in the production plant and independent of pole diameter, pole length and pole function. The induo® anchor technique as a system-connection joints cross beam and pole and forms the shearing joint of the pole top end. Through the factory-provided production with always identical and patent-registered beam molding tool, we reach measure margins of less than 2 mm, as they are common in steel building, in all connections between timber-timber, timber-steel and the steel components.

Angle span Pole Medium / low voltage

induo® Wood Poles

The completion of induo® angle bracket and angle span poles is carried out equally to the production of the A terminal tower. Only the installation direction and the cross-beam construction differentiate the angle A pole from the dead-end tower.

The always identical induo® system connection leads the loads of the cross-arm safely over the two horizontally laying anchors into the poles. The anchor pins, together with the pins of the vertical anchor, transmit the shearing powers of the bevel joint between both pole top heads. The bolts take over the powers of the overturning effect of the shearing joint. The connection to the cross arm is a normed steel/steel connection.

The connection to the timber is a dimensionally accurate and highly load bearing timber joint.

Induo® Wood A Poles

Programm range A poles

induo® Wood Poles

The induo® angle bracket-, dead-end and terminal A poles are delivered in the following measurements – ready-for-assembly. The tensile load forces in the table were calculated following DIN EN 50423 and include the horizontally allowed overall tensile force, already moderated by the wind load on the pole appearing at the top head.

The stated A pole needs to be checked depending on the chosen rope diameter, span width and wiring angle. Soil conditions and ground clearance for profile changes have to be verified separately. The poles in the table marked with ”n“ are changed in their strutting compared to DIN 48351.

Short mark	pole length l m	food-Ø f_{mind} cm	top end-Ø z_{mind} cm	traction force at A-pole-level wind zone 1	traction force at A-pole-level wind zone 2	at pole head against A-pole-level wind zone 1	at pole head against A-pole-level wind zone 2
2x 1022	11	26	20	18.54 KN	17.52 KN	5.86 KN	5.79 KN
2x 1025	11	26	20	23.49 KN	23.49 KN	8.18 KN	8.09 KN
2x 1123	12	30	22	18.05 KN	17.05 KN	8.18 KN	8.09 KN
2x 1127	12	30	22	26.12 KN	25.96 KN	8.18 KN	8.09 KN
2x 1224	13	30	22	17.47 KN	16.03 KN	7.39 KN	7.27 KN
2x 1229	13	30	22	26.42 KN	26.24 KN	7.38 KN	7.27 KN
2x 1326	14	31	22	16.90 KN	15.06 KN	7.41 KN	7.28 KN
2x1329	14	31	22	25.89 KN	25.69 KN	7.41 KN	7.28 KN
2x 1426	15	32	v	15.97 KN	14.18 KN	7.46 KN	7.31 KN
2x 1430	15	32	22	24.48 KN	24.26 KN	7.46 KN	7.31 KN
2x 1531	16	33	22	15.13 KN	13.38 KN	7.54 KN	7.37 KN
2x1633	16	33	22	23.21 KN	22.94 KN	7.53 KN	7.36 KN

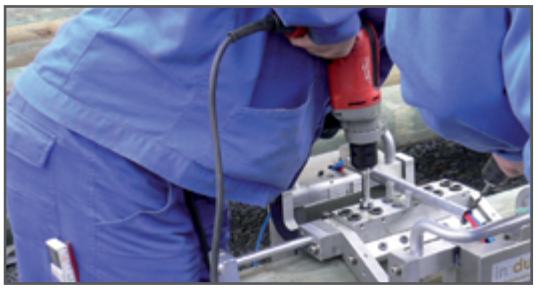
Note: Poles marked with ”n“ are changed in their strutting compared to DIN 48351

Induo® Wood Poles

Production – induo® Wood Poles

Raw wood poles:

The raw material for the wood poles are domestic pine or spruce logs, which are made branch-free and peeled. For medium voltage towers, poles of up to 18 m lenght are used.



Seizing of the Poles:

The wood poles are prepared at the pole producer with all necessary drillings and millings. For A poles, the millings and drillings are carried out custom-fit by means of a surface stencil. For suspension poles the accurate drilling is ensured by means of a pneumatic drilling stencil.

Impregnation of the wood poles:

After the wood pole has been prepared with all drillings and millings and has been cut into the appropriate length, it is impregnated via boiler pressure procedure. Hereby wood poles receive a very high life and serving durability.

Storage of the wood poles:

The finished wood poles are temporarily stored at the production plant of the wood pole manufacturer until they are delivered. The most common wood pole types are produced ahead in order to allow a fast, custom-tailored delivery.

Induo® Wood Poles

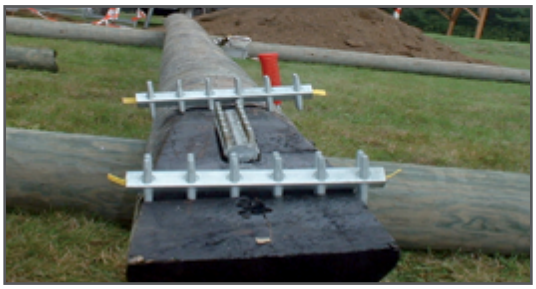
Transport and assembly – induo® Wood Poles

Transport of the wood poles:

The transport of the wood poles is carried out on schedule to the building site with required connection aids for the corresponding cross beams.

Setting of the induo® anchor:

The induo® anchors are easily inserted into the appropriate drillings and millings. No tools required. Just clip the anchor on - ready!



Assembly of the wood poles::

The single parts of the A poles finally have to be put together and secured with stud bolts. For suspension and twin poles, the anchors are located with bolts and fastened with additional timber wrench screws. In both cases, only a screw wrench is needed.

Connection of the cross arm:

The prepared cross arms are connected onto the anchor with a simple bolt joint.

Again, only a screw wrench needed!

Induo® System Components

Cross arm systems for medium voltage

induo® Utility Pole-Systems

We offer standardized cross arm constructions for common European wiring systems of overhead lines that go with the induo® Wood Poles and induo® Engineered Timber Poles. The cross arm systems have been developed in cooperation with various energy suppliers and network operators and have been adjusted to the common field span widths, conductor spaces, isolations and connections. Regarding their completion, quality and anticorrosive, they meet the regulation and specifications of most energy suppliers and have therefore been statically proved.

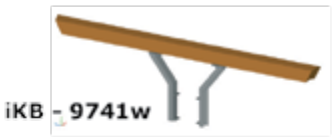
- **Suspension pole cross arms**
For wood poles, single poles, twin poles and induo® Engineered Timber Poles with supporting, hanging or mixed isolation construction and corresponding phase spacing.

- **Angle bracket cross arms**
For wood poles, A poles and induo® Engineered Timber Poles for the construction of angle bracket and angle span poles.

- **Dead-end- / terminal tower cross arm**
For wood poles, A poles and induo® Engineered Timber Poles for the construction of dead-end and terminal tower poles.

Abstract of the delivery programme: standard cross arms medium voltage, wind span widths up to about 120 m

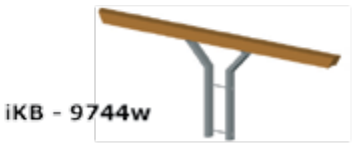
- **Suspension pole cross arm**
standing isolator design phase spacing 1.500 mm



- **Angle bracket cross arms**
hanging isolator design phase spacing 1.500 mm

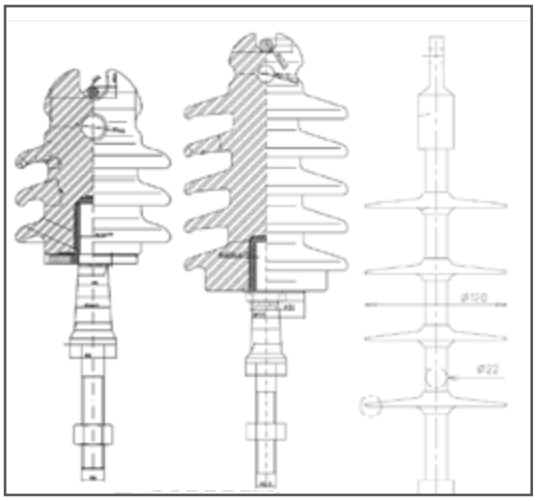
- **Angle bracket cross arm**
strutting chains phase spacing 1.600 mm.

- **Dead-end pole cross arm**
strutting chains phase spacing 1.600 mm



- **Customer fabrication** standards according to needs

Induo® System Components



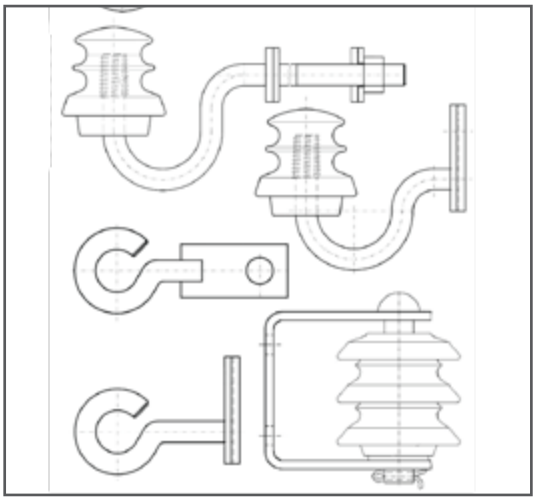
System Components for LowVoltage 1kV

Insulators, connection parts and components

To provide complete customer care we deliver our products as a system including all the accompanying engineer performances, conductor calculations, connections, small parts and insulators all ready for assembly to the site of construction or to the assembling company.
We supply:

- Link plates, hooks, clamps for ISO-Lines
- Strain hooks, cross-members
- Cable clamps, mounting clamps
- Anchor link plates, anchor plates
- Services clamps and shackle insulators
- Suspension insulators
- Strain insulators
- Strain clamps and suspension clamps

and much more ranging up to customised components and special elements.



System Components for Medium Voltage 20 – 30 kV

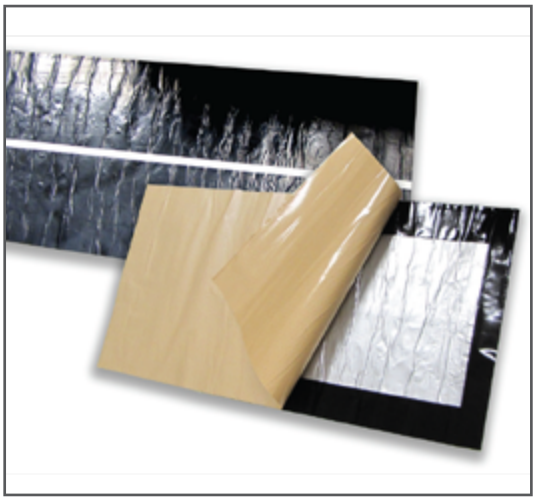
Insulators, connection parts and components

We supply:

- Post-/ Supporting insulators
- Long-rod insulators
- Suspension insulators
- Plate supports, straight and curved insulator supports
- U-bolts
- Strain hinges
- Suspension hinges
- Eyelets
- Clevis and tongue couplings
- Bird protection equipment

and much more ranging up to customised components.and special elements.

Induo® System Components



Wood Pole Protective Bandage induo® LoPro (Long Protection)

For induo® Round Wood Poles and induo® Engineered Timber Poles

For the protection of poles at the ground/air area, induo® Round Wood Poles and induo® Engineered Timber Poles are alternatively also delivered pre-wrapped with the induo® LoPro wood pole bandage.

The induo® LoPro system protects and stabilises wood poles permanently underground and at the ground surface area. The system wraps the pole in an approximately 0.3 mm thick technically approved blocking zinc foil. The induo® LoPro system is UV and IR stable, it protects the pole by means of a self-vulcanising and crackbridging barricading layer from environmental influences

The poles are available immediately after the application of the induo® LoPro bandage (no long term storage and drying out times such as with poles with a tar coated foot).

induo® LoPro-is Preventive Protective Bandage

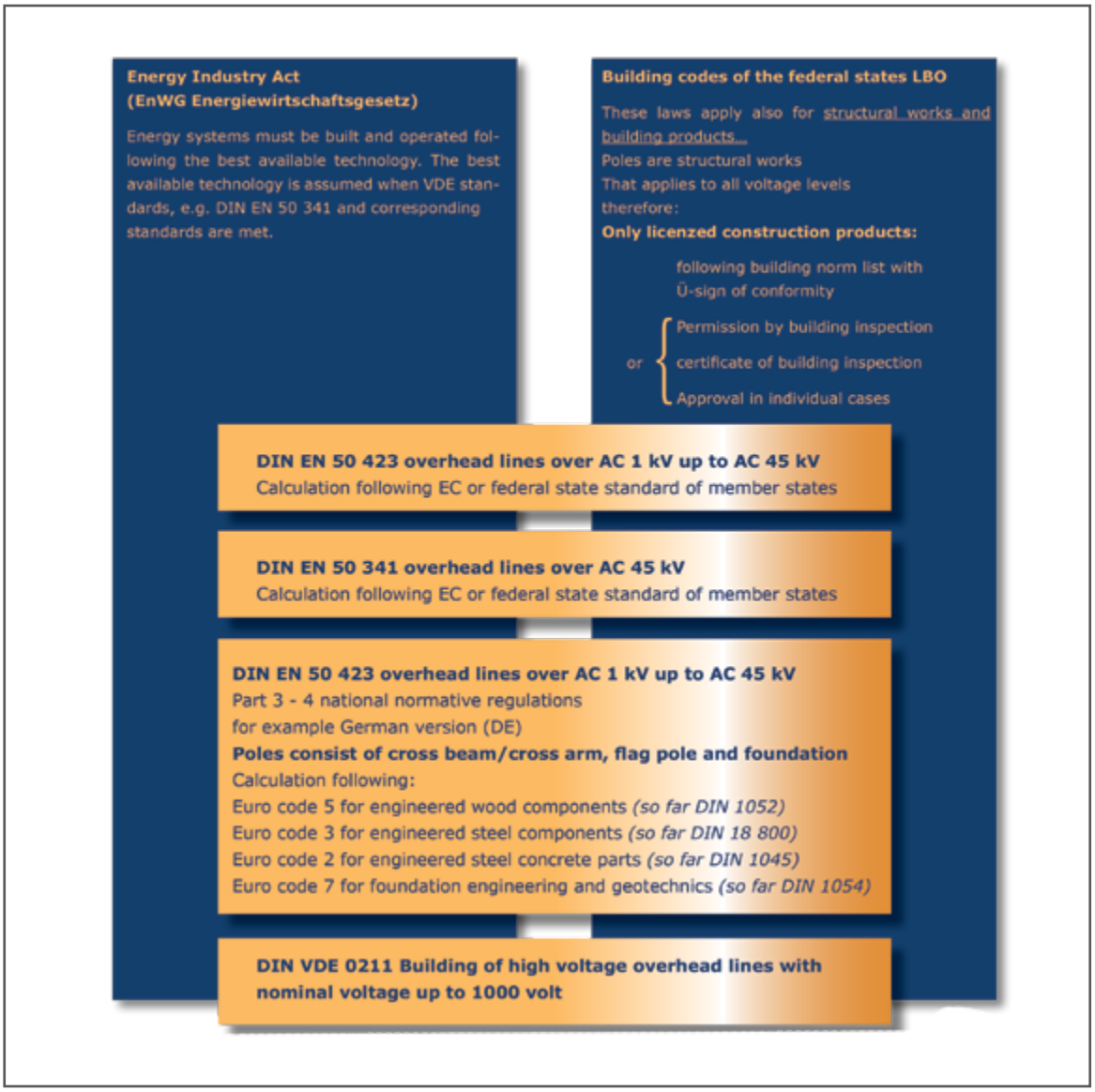
For the aftercare of existing round wood poles

For the better aftercare of existing round wood poles we are able to supply our customers with the induo® LoPro system as a preventive protective bandage in a manageable size. The system is completely self-adhesive and in addition, all components are preassembled for swift adaption during aftercare on site.

Induo® Utility Pole-System

Legal foundations and DIN-standards for overhead lines of all voltage levels

The Energy Industry Act as the federal law manages the basic demands on energy systems, the building codes as state laws regulate the demands on the construction work – also of license-free structural works.



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