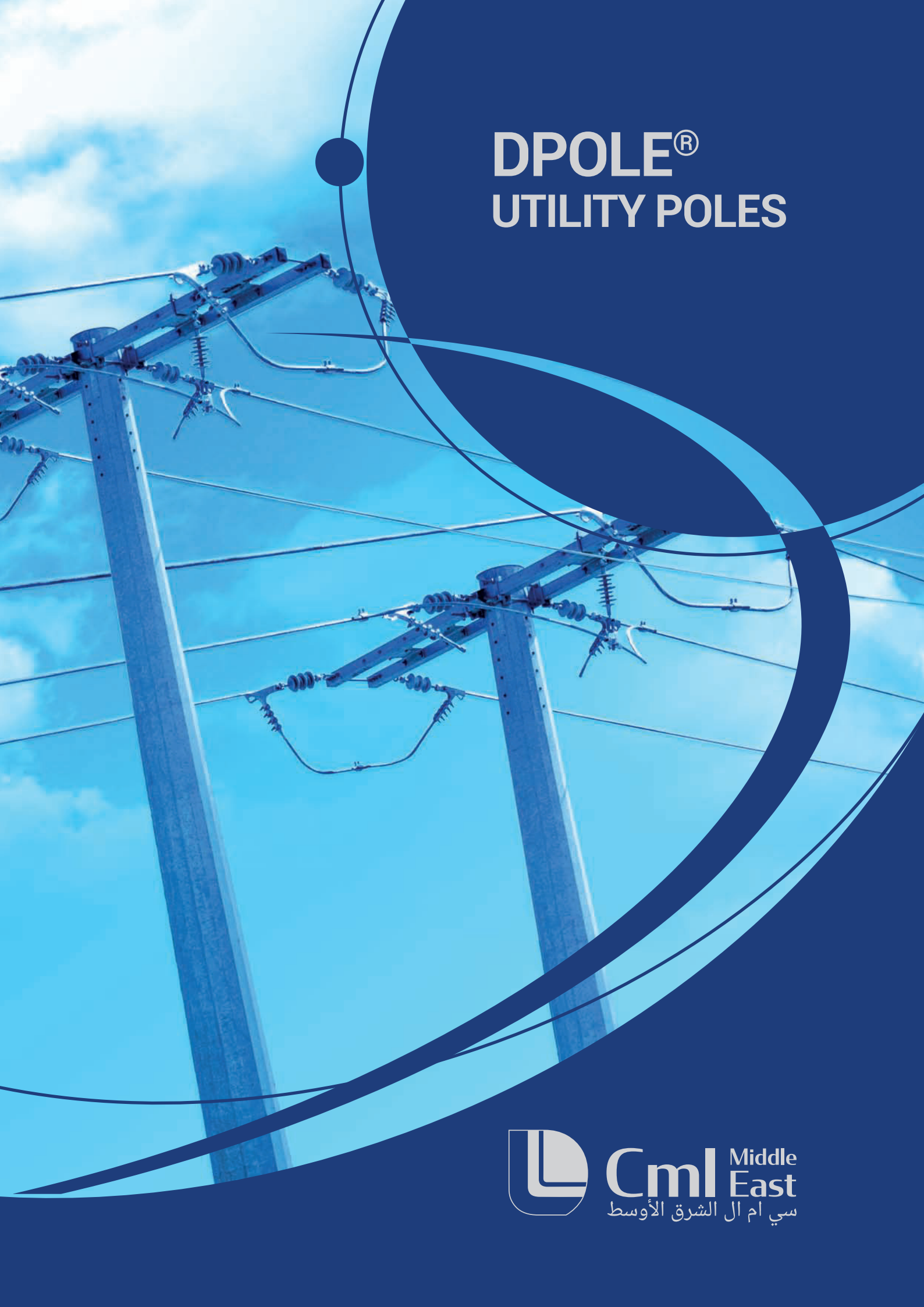


DPOLE®
UTILITY POLES

Cml Middle East
سي ام ال الشرق الأوسط

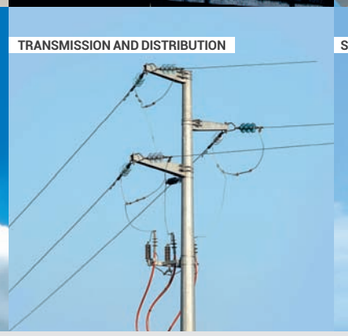
INDEX

Our History

Our origins

Del Carlo Group is a conglomerate of four leading Italian companies in the fields of galvanization, industrial painting and the manufacturing of steel supports, with a total production area of 170,000 square meters.

The consolidated success of Del Carlo Group results from a long tradition for excellence, as well as a proven track record of market success evidenced by the longevity of the group's first hot-dip galvanizing unit and pole production factory which trace their roots all the way back to 1950 and 1960 respectively. The affinities and the values of the individual companies have merged to create a global group which is at present supporting some the world's leading companies in the energy, telecommunication, railway and infrastructure sectors.



A GROUP IN CONSTANT EVOLUTION

Team

Investment in research and development, application of advanced technologies, expertise and passion – these are the values that continue to support Del Carlo Group's evolution. Created through the vision and action of Lorenzo del Carlo, Del Carlo Group has since grown to become a reference in the Italian market within the sectors of public lighting, electricity transmission and distribution, railway infrastructures, galvanization and industrial painting.

Del Carlo Group's market leadership is assured by the dedication and competence of the expanded Del Carlo family, which in addition to its founder Lorenzo and son Alfredo includes passionate and enthusiastic managers.

A group of people united by common ideals where each individual is free to express their full potential and capabilities without reserve.

lorenzo del carlo metalzinco macofer cml

PRODUCTS AND SERVICES

Research and development

Design and sustainability: innovation starts here

Del Carlo Group's history is marked by innovation and intuition which come from continued investment in people and frameworks designed to enhance production processes and create unique cutting edge products.

The group's aim is to constantly evolve and maintain its growth trajectory in order to meet both global demand and anticipate clients' future needs.

Our new projects are designed to upgrade urban aesthetics and create advanced integrated systems for future smart cities leading to more efficient and functional lighting systems as well as new communication systems and energy transmission networks with wider reach.

Environment

Sustainable development for a better tomorrow

Del Carlo Group has always been committed to the development of environmentally friendly products. Some concrete examples include reduced energy transmission towers, use of renewable energy to power lighting systems such as the 'stand alone' system powered by solar energy, optimization of supports for wind
power generation.

With a clean environment in mind, Del Carlo Group ensures streamlined automated and manual production processes to minimize emmisions and maximize energy savings and efficiency, and manufacturing activities are fully certified to comply with the utmost demands of the market.

Values

Vision

Help to improve people's lives by bringing illumination to every part of the world, improving people's mobility.

Mission

To become a leading multinational Group in public lighting systems and steel structures for electricity lines and telecommunications grids developing new products for smart city that can improve people's mobility with structures for electrical cars and structures for sustainable mobility (metro in surface mobility).

We will accomplish this mission by:

- designing and manufacturing products with high standards in terms of quality, safety, design and innovation;
- pursuing efficiency, safety and sustainability in production processes.

Numbers

- 4 Plants in Italy: 2 Chiusi (SI), 1 Pegognaga (MN) 1 Uzzano (PT)
- 32,500 m² covered area
- 170,000 m² total area
- 200 employees
- 10 production lines
- 30,000 tons of steel processed per year
- 60,000 tons of hot - dip galvanized steel

DEL CARLO GROUP IN THE WORLD

Local presence, global reach.

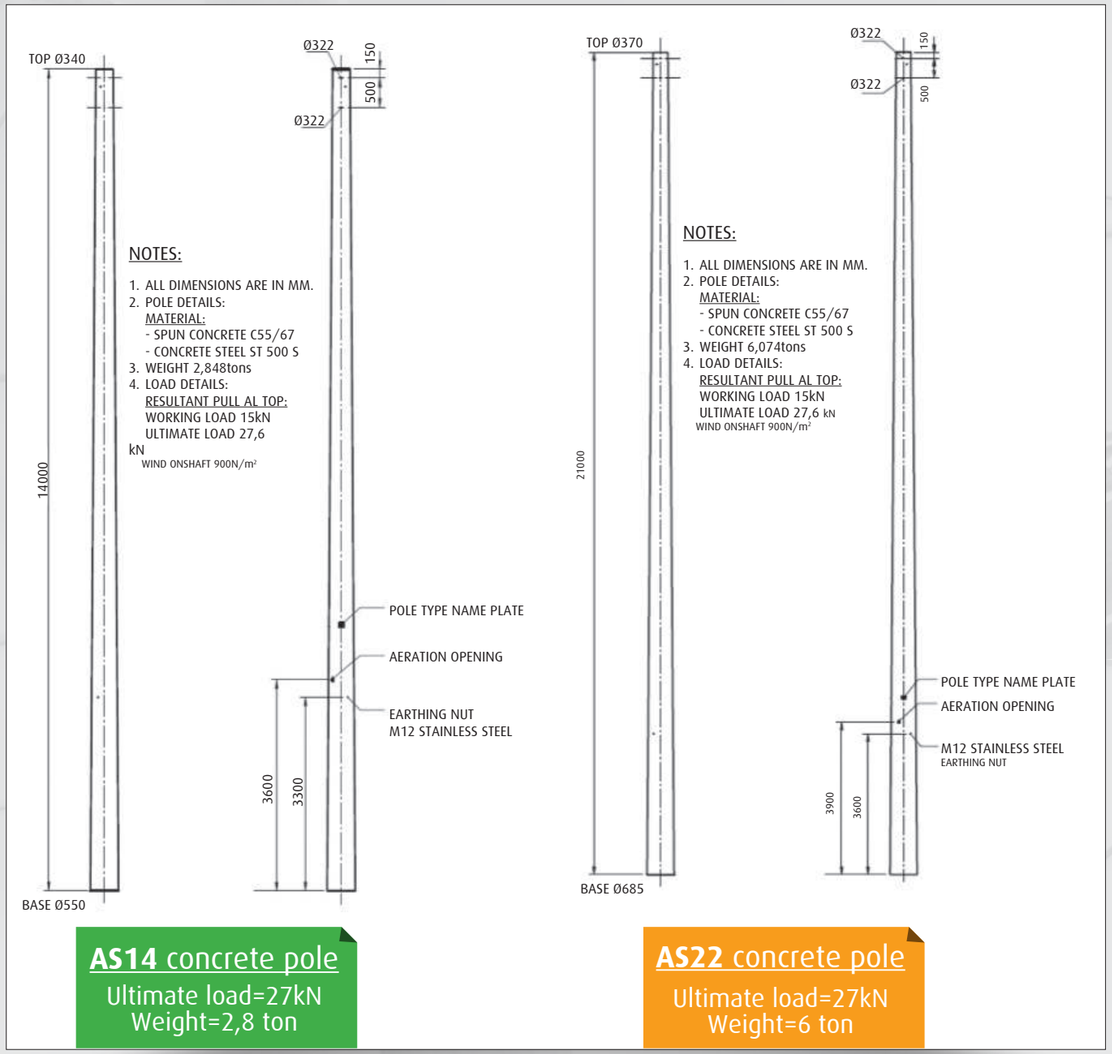
Del Carlo Group is structured to assure a close relationship with clients worldwide while maintaining efficient and timely service.
The Group's multinational presence continues to grow beyond European borders - including emerging markets in Africa and the Middle East.

Group's plants
Sales presence

HOT - DIP GALVANIZED STEEL POLES

In the modern society the electric power has a crucial role, not only it defines the development of a Nation, but has become an essential element of our daily life or of our activities on the territory. A primary role for turning on the lights and the computer, but also and above all for every handicraft or industrial activity, is played by the distribution of the electric power, that needs a strong and reliable, as well as durable network. This primary role for the development and for the daily activity has to be played even with whims of the winds, agricultural fires, ice, floods and of the weather.
The galvanised steel distribution poles sustain the electric cables in a reliable and safe way maintaining the users safe, connected and productive granting the economic development.
The galvanised steel distribution poles take part at the construction of a network that is reliable, durable and economic, when and where necessary.
The galvanised steel distribution poles have a minor environmental impact (compared to wooden and concrete poles) and grant a 100% recycling.

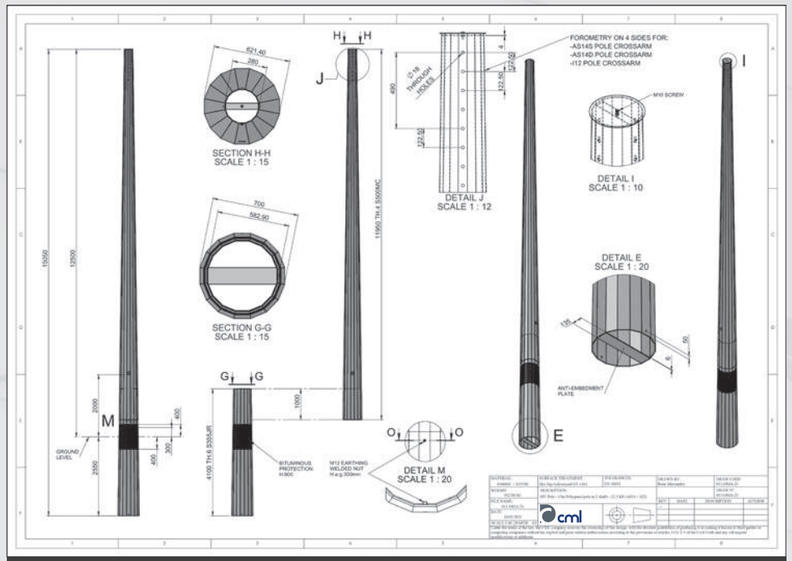
UTILITY POLES
STEEL vs CONCRETE



AS14 concrete pole
Ultimate load=27kN
Weight=2,8 ton

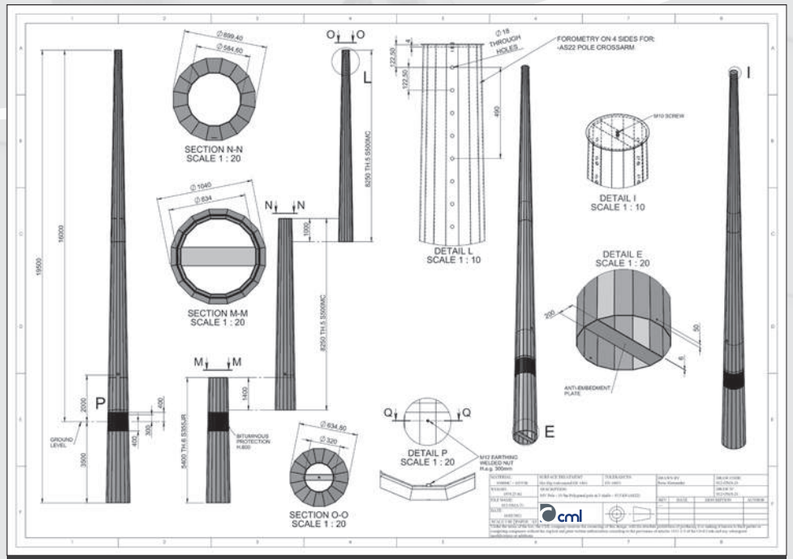
AS22 concrete pole
Ultimate load=27kN
Weight=6 ton

Making a comparison between steel and concrete poles (in the same range) it looks clear that steel poles are lighter than concretre one (even 3 times ligher in our case) so a small crane is more than enough for erection.



AS14 steel pole
Ultimate load=21kN - Weight=0,9 ton

Typical Label
(to be definied with customer)



AS22 steel pole
Ultimate load=45kN - Weight=2 ton

Typical Label
(to be definied with customer)

TECHNICAL SPECIFICATIONS

MECHANICAL BEHAVIOUR

The metallic supports are dimensioned in order to resist to the nominal load F and on the wind pressure V applied at 0,25 m from the top. Under theses loads, the assured safety coefficient is significantly elevated and the pole resists to an elevated torque. Tests have shown that the destruction of the support occurred over a coefficient of 2.1. Moreover, the collapse of the support does not occur with a sudden break (as it is for the wooden or concrete poles) but through a plastic deformation or a local curvature of the connection section together with important deformations that allow the pole to still sustain part of the initial loads.

STEEL

The steel utilized is in accordance with the EN 10025 class I type S500 and has the following features:

- Elastic limit Re = 500N/mm²
- Granted resistance at -20 C
- Suitable to be galvanized according to NFA 35503 class I.

Protection against corrosion

A product certificate of conformity can be supplied to the customer on request.

GALVANIZATION

- ***Hot - dip galvanization***

The distribution pole is hot – dip galvanized according to EN 1461(or CEI 7-6 or ASTM A 123 or other standards depending from customer indication) in order to obtain an even zinc coating in both, the interior and exterior of the pole.

- ***Protection of the embedded part***

On request of the customer, the pole can be supplied with an additional bituminous protection (realised according to the customer's specifications).

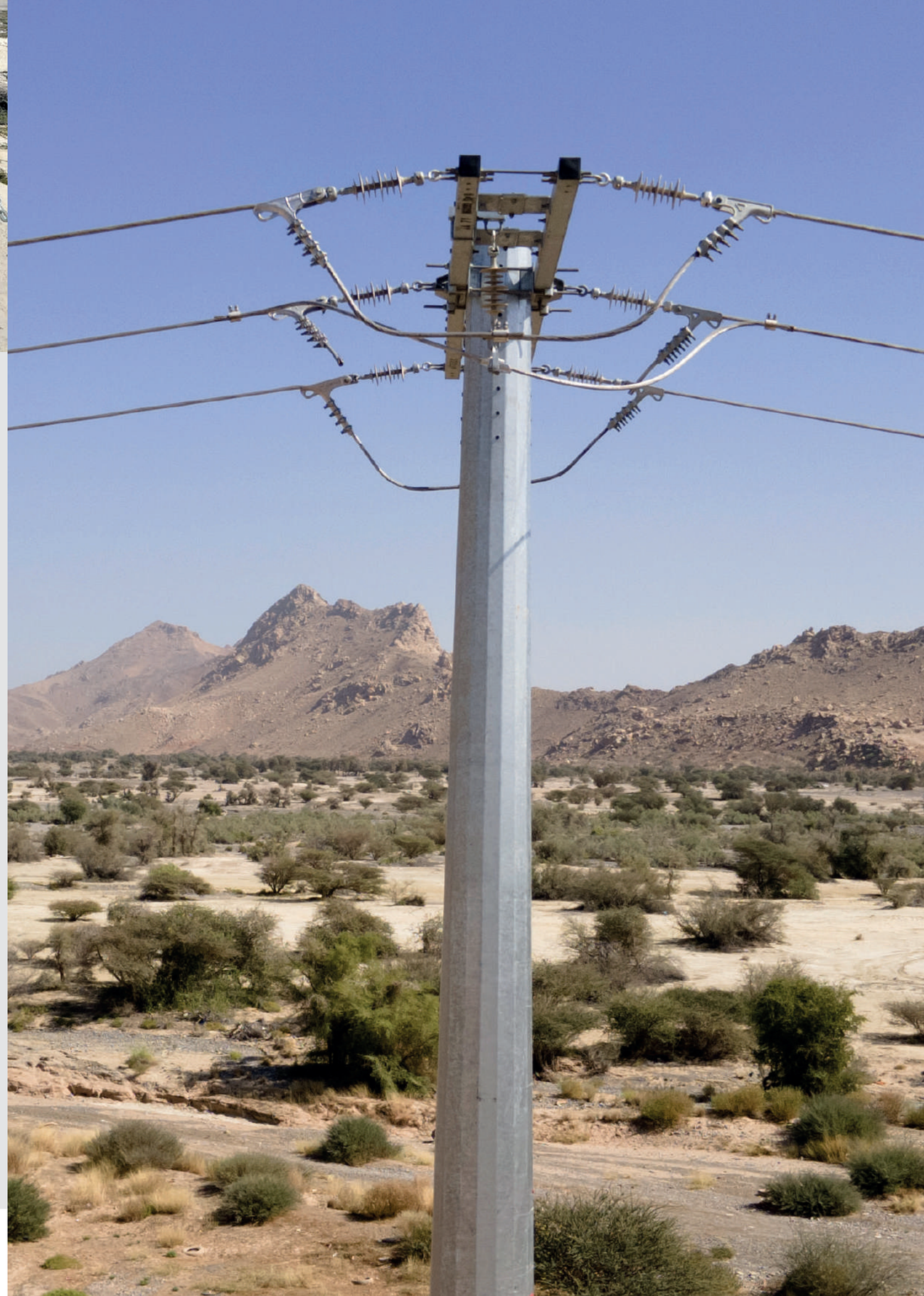
TECHNICAL SPECIFICATIONS

Manufacturing tolerance

- Length of the elements: from 25 mm to + 75 mm
- Linearity: 2 mm per meter
- Torque: 1 grade for a length of 3 m
- Ovalisation: Max 3%
- Average diameter: +/- 0,5%
- Joint: +/– 150mm

Standard accessories:

- Head cap
- Standard holes
- Data plate
- Earthing
- Bituminous protection



STANDARD FABRICATION DETAILS

The distribution poles are realised in a standard version with the following equipment or details:

- 5 pass through holes with a diameter of 18 mm and positioned regularly from the top.
- A M10 earthing nut positioned at 250 mm from the theoretical level of the ground.
- A top cap
- An identification plate showing: total height of the pole; the maximum eligible load with a coefficient 1; year of production; brand of the manufacturer (the plate can be customised according to the specifications /indictions of the customer).

The assembly of the poles on the ground is through embedment installation.

Over 12m the poles are realised in two sections.

As an option and on customer's request, the distribution poles can be supplied with:

- Specific identification plate
- Additional holes for the change of lighting fittings or additional accessories on the head.
- An additional earthing nut of the electrical fittings fixed on the head of the pole.
- An anti - embedment plate on the base of the pole.
- A bituminous protection of 800 mm (400 mm under the ground and 400 mm above) – that can be modified according to the specifications/indications of the customer.
- Elements for the anchorage of the ladder or use of the climbing ladder.
- A series of removable rungs for access to the top.

GEOMETRY

The distribution pole has a regular polygonal section (8 or 12 or 16 sides) that offers resistance in all directions. The poles of up to 11,9 m are made by just one section, above 12 m they are built into two or more sections assembled on the construction site through coupling. The nominal retrieval height must be equal to 1,5 times the average diameter among the edges of the top section. The acceptable effective joint height realised on the site must be higher than 1,35 times the diameter among the edges of the top section.

MANUFACTURING

LONGITUDINAL WELDING

The longitudinal welding of the section is realised through the submerged welding following a qualified operational procedure and in accordance with standard ISO 15614-1.

QUALITY

The poles are manufactured on a site that is certified ISO 9001. The manufacturing and control procedures are clearly defined in the quality manual.

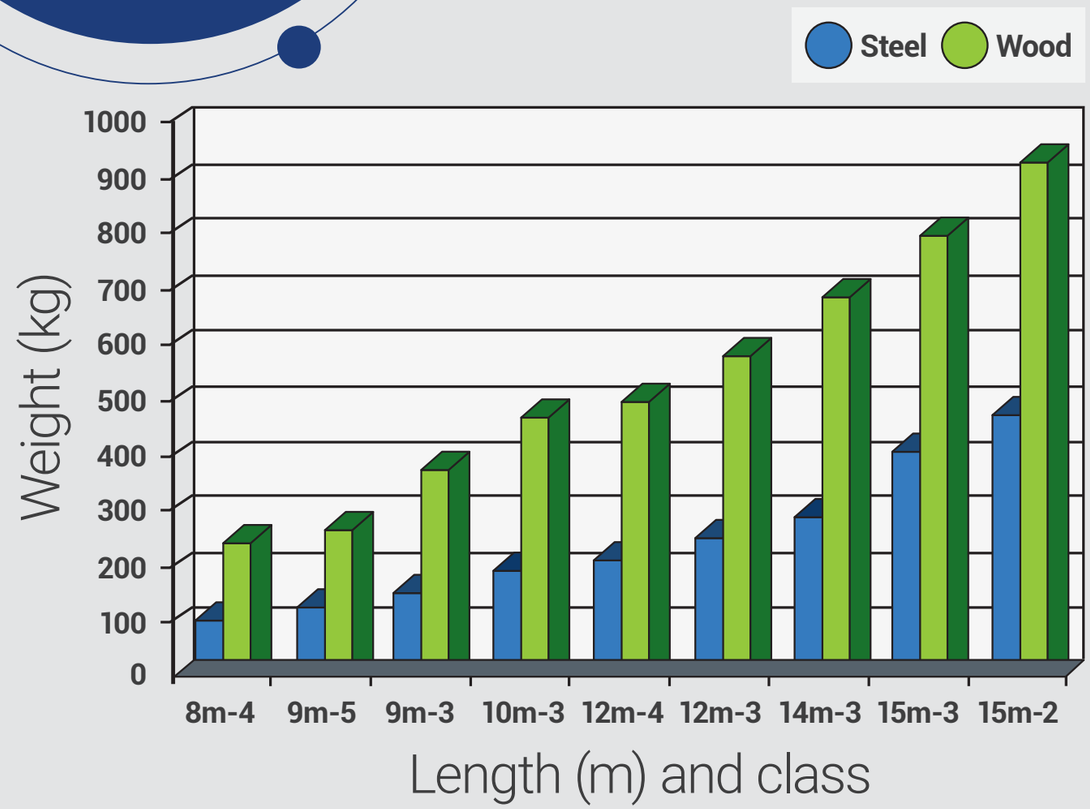
OTHER

The holes, the welding and other operations are realised before the galvanisation in order to ensure that the whole surface of the pole is protected from corrosion.

DIMENSIONS AND ELIGIBLE LOADS

The eligible load is the one that leads the pole to the steel's minimum granted elastic limit with the wind, vertical load and variable safety coefficient. The application of a load due to the wind or the addition of accessories on the pole (vertical load), as well as taking into consideration a safety coefficient, complicate the selection procedure of a pole and needs a specific calculation.

UTILITY POLES SOLUTIONS COMPARISON

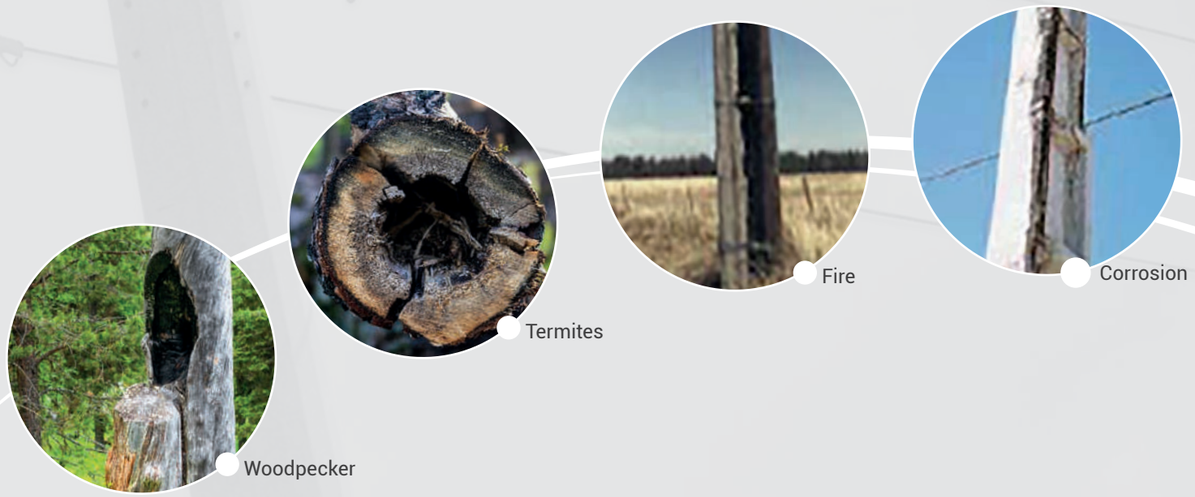


	STEEL	CONCRETE	WOOD
Life forecast	**60 years**	30 years	10 years
Weight	**254 kg**	1350 kg	790 kg
Installation costs	**low**	Very high	high
Transport costs	**low**	Very high	high
Maintenance costs	**low**	low	Important
Remaining value (recycling)	**Positive**	Negative	Negative
Influence on the environment	**low**	high	Average

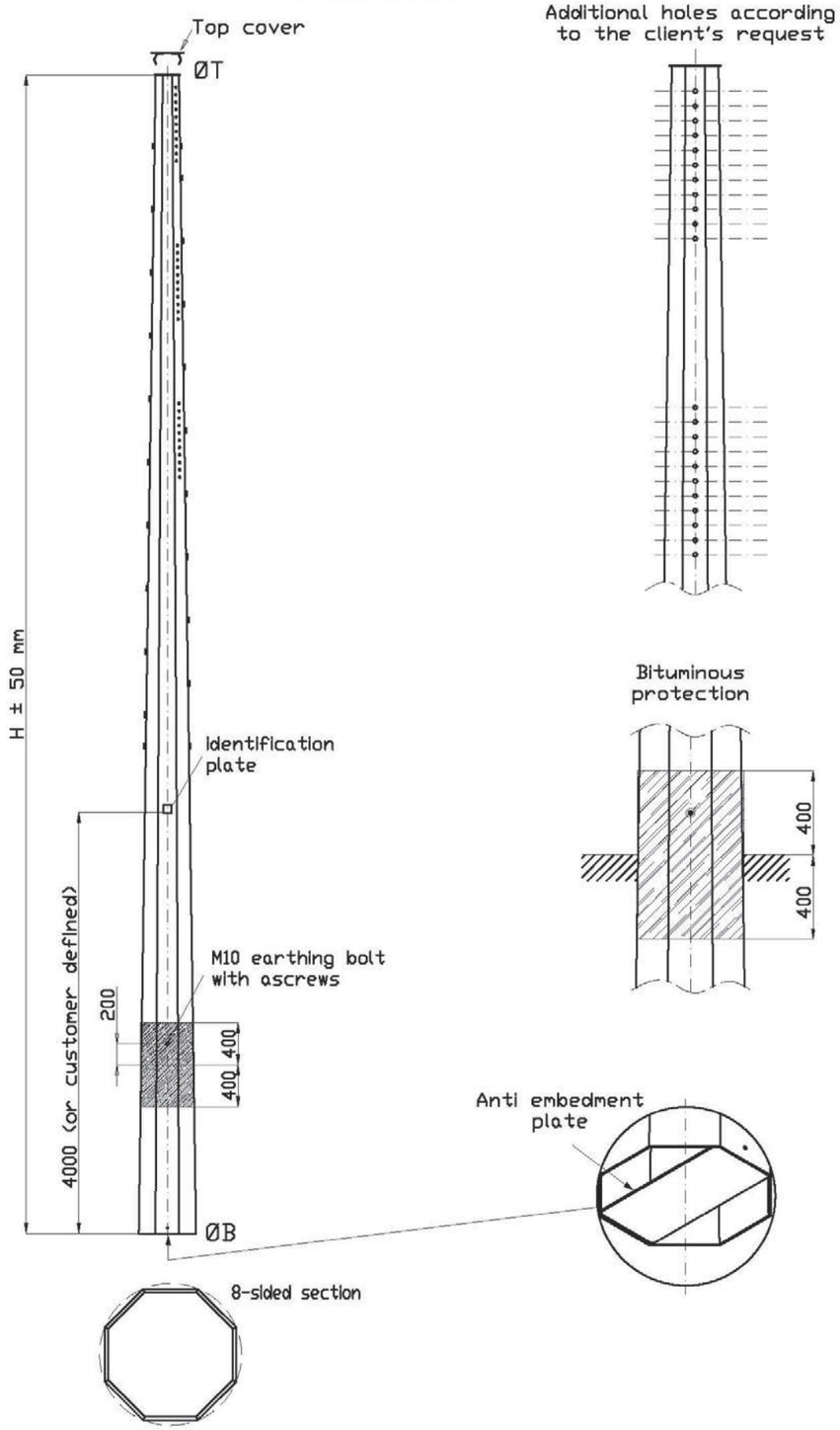
11 KEY POINTS OF GALVANIZED STEEL POLES COMPARED TO WOODEN OR CONCRETE POLES

1. Estimated lifespan of 60 years (6 times the one of a wooden pole and twice of the concrete poles)
2. 3 times lighter than a wooden pole and 7 times lighter than a concrete pole (cost reduction for transport and erection).
3. Reduction of the “domino” effect risk if a pole falls.
4. They do not burn (no risk with agricultural fires).
5. No maintenance requested (it is not necessary to tighten the assembly hardware, nor to treat them).
6. Resistant to attacks of insects, woodpeckers, rodents.
7. No toxic treatment with arsenic materials (forbidden in many countries) for public health reasons.
8. They are not porous, no infiltration is possible. They also do not break the effects of ice (or deflect with high humidity level).
9. Very economic alternative for head or corner poles. They can increase the lifespan by reducing the number of poles on the line.
10. They have a flexibility that allows to regain the imbalances within the lifespan rates (for example breaking of the cable due to freezing). This cannot be allowed by rigid supports such as concrete ones.
11. Limited environmental impact with a 100% recycling possibility (impossible for wooden poles because of the treatments, and for concrete poles – both solutions have a major impact on the environment).

Disadvantages of the wooden and concrete poles



DISTRIBUTION DPOLE RANGE



OPTIONS

DPOLE LAYOUT AND OPTIONS

I12 STEEL POLE

Intermediate suspension pole designed for a 33 kV line with a basic span of 90 m

Ultimate load = 21 kN
Weight = 0,9 ton

AS14 STEEL POLE

Terminal or angle pole designed for a 33 kV line with a basic span of 90 m

Ultimate load = 21 kN
Weight = 0,9 ton

AS22 STEEL POLE

Design for a 33 kV line with a basic span of 175 m

Ultimate load = 45 kN
Weight = 2 ton

CROSSARMS

AS14
TENSION
CROSSBAR

Double

Single

AS22
TENSION
CROSSBAR

Double

I12
SUSPENSION
CROSSBAR

DPOLE ACCESSORIES

POLE SUPPORTS

SURGE ARRESTERS SUPPORT

DISCONNECTOR SUPPORT

CABLE SUPPORT

DPOLE ASSEMBLY SLIP ON JOINT

Slip on joint by hydraulik jack

Slip on joint by tirforts

DPOLE
POLE & SUPPORT ASSEMBLY

POLE ASSEMBLY

SLIP ON JOINT DESIGN CALCULATION

SLIP ON JOINT DESIGN (MAX FORCE)		
N° sides of polygonal section:	16	
Taper:	0.02857	
Female shft tickness (S_p):	4	mm
Steel quality female section (S...):	500	5000
Slip on joint lenght:	1000	mm
Safety coefficient:	1.5	
Admissible load (σamm):	3333	kgf/cm²
Slip on joint max force (F_i):	10107	kgf

SLIP ON JOINT DESIGN (LENGHT)		
N° sides of polygonal section:	16	
Coefficient η:	3.040	
Friction coefficient μ (galvanized steel):	0.3	
Coefficient ξ* and safety coefficient K:	10.332	mm
F/F diameter of male shaft (Ds):	571.7	mm
Tapero (c):	0.02856	
Key of femal shaft (ds):	560.7	mm
Base material slip on joint lenghte (i_{min}):	752.2	mm
2ª class weiled material slip on joint lenght (i_{min}):	887.9	mm

Slip on joint max force - 10107 kgf

Minimun slip on joint on joint - 888 mm

SUPPORT ASSEMBLY

CROSSARM ASSEMBLY

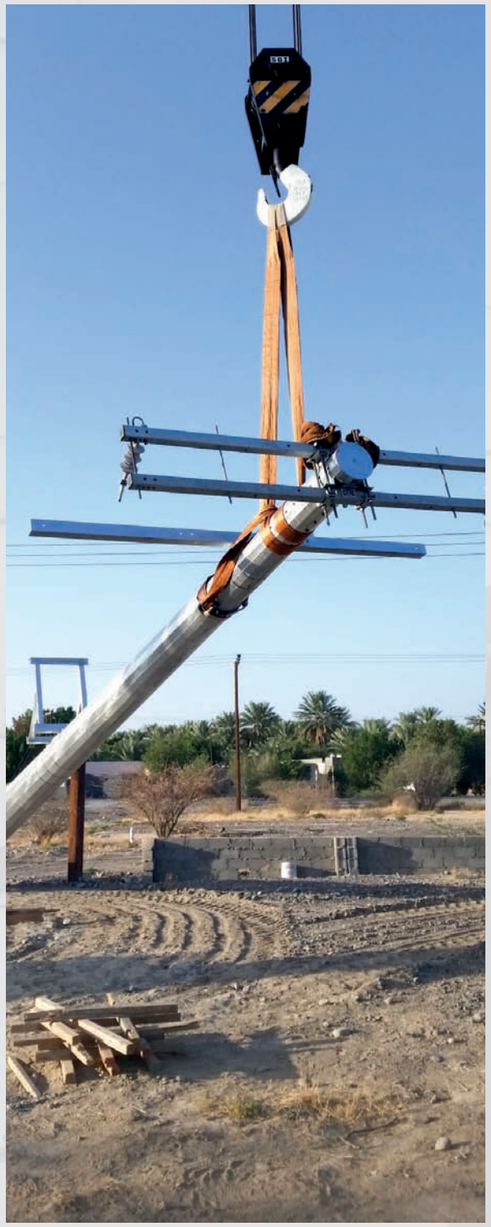
Pole will present a set of holes on each side in order to install the crossarm at different level on the top of the pole. This solution will help to level the conductor depending from ground condition. Un-used hale ae covered with PE or PVC caps.

Following detailed drawing for each crossarm (provided) it will be installed on related pole. A top cap in hot dip glavanized steel will be also applied and all openings will be covered with PE o PVC caps.

DPOLE INSTALLATION & ERECTION

1 HOLE DRILLING

2 HOLE CHECKING



3 SLINGING AND ERECTION

4 POLE LIFTING

5 HOLE APPROACH

6 HOLE CENTERING

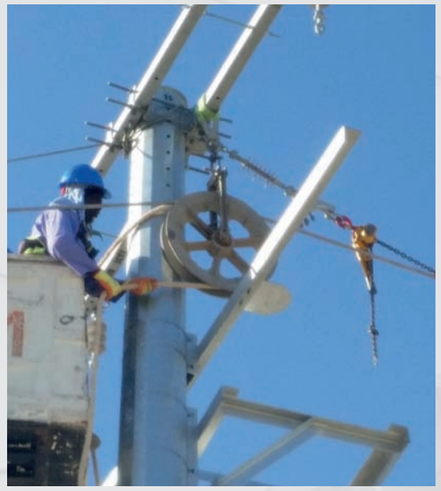
7 GROUND EMBEDMENT

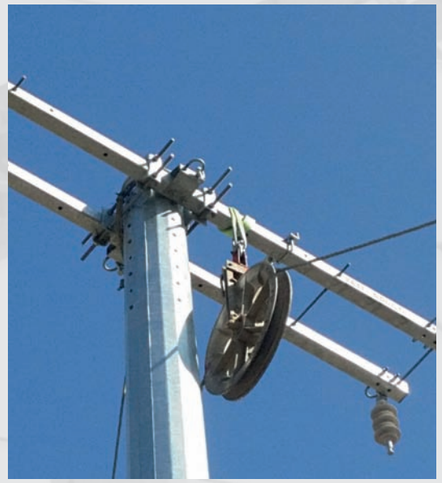
8 EMBEDMENT CHECKING

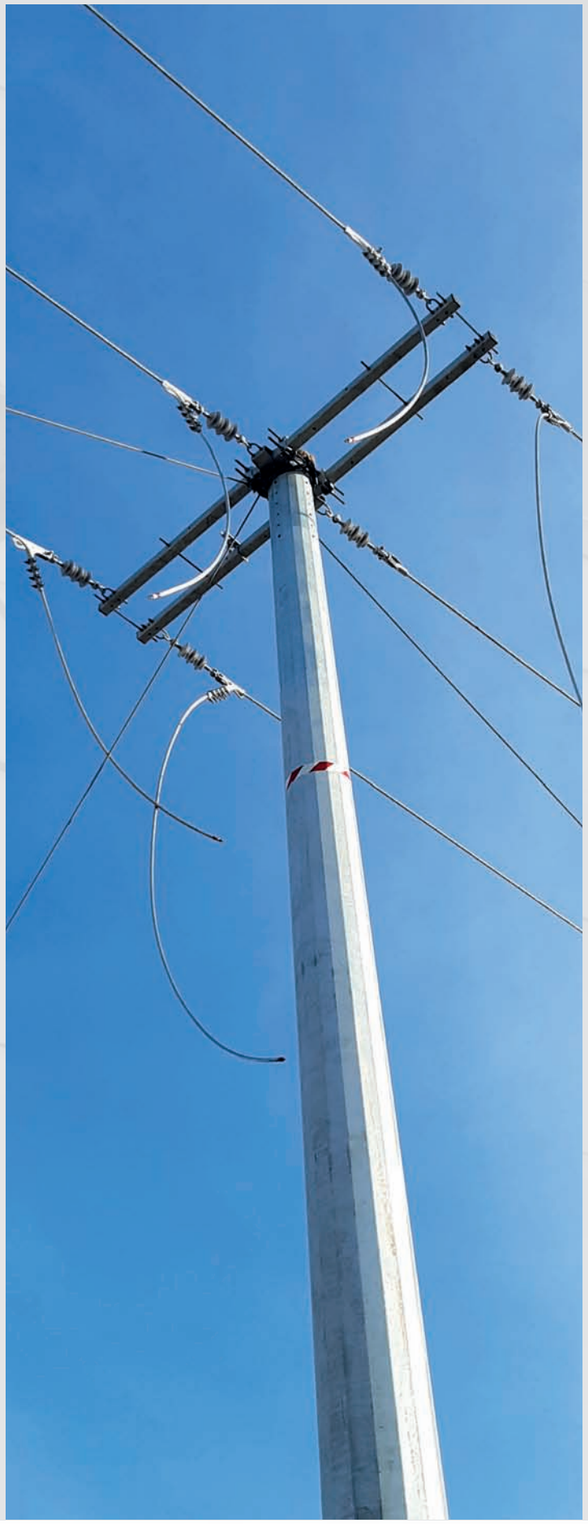
9 BACK FILLING

10 FINISHING

DPOLE CONDUCTOR STRINGING AND SAGGING







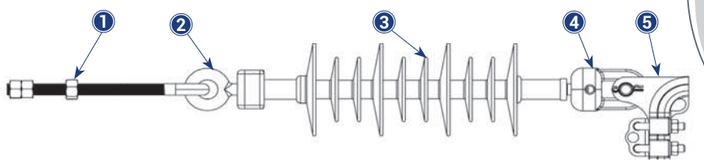
DPOLE
BACK FILLING

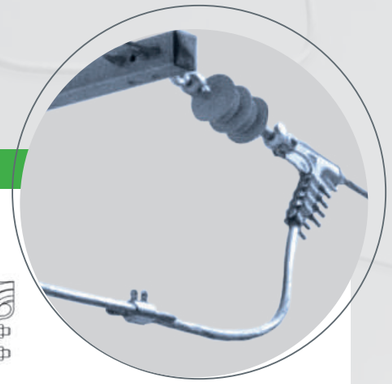
BACK FILLING
ON CONCRETE

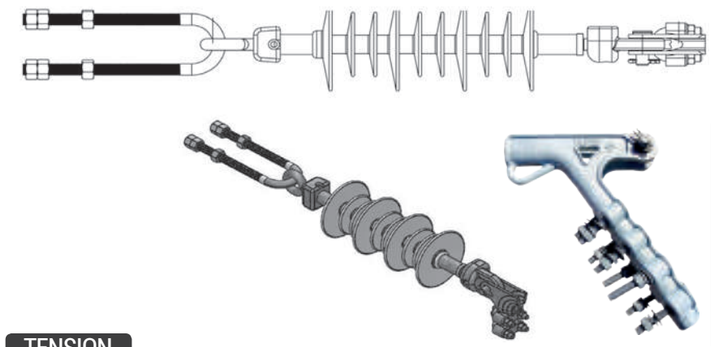
SAND + WATER BACK FILLING
(FOR POLES EMEBDDED DIRECTLY IN GROUND)

CONDUCTOR STRINGING CHAIN LINK

Tension chain link in composite 70kN composed of:



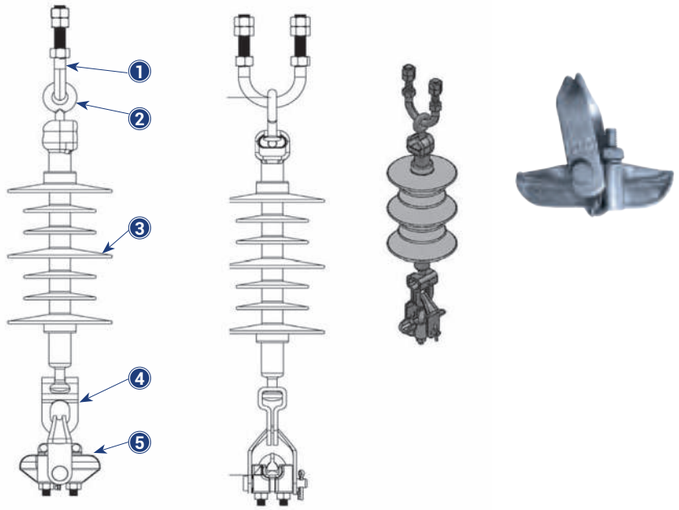




1. U bolt E16140
2. Eye Bolt OR70
3. Insulator ISI-TWE-A35-70SB
4. Ball socket BS70
5. Anchoring clamp GA1P

TENSION

Suspension chain link in composite 70kN composed of:

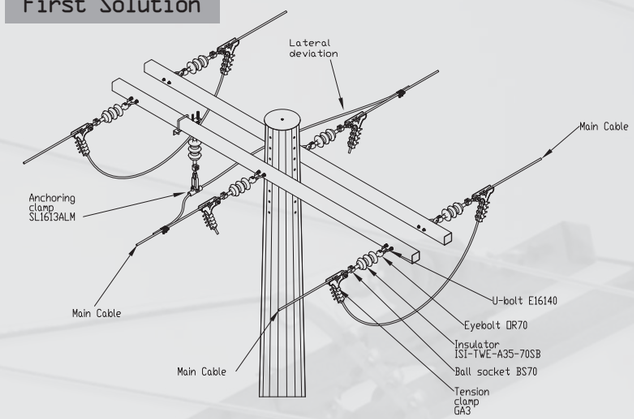


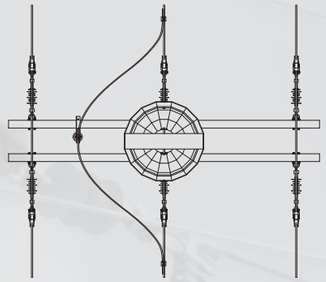
1. U bolt E16140
2. Eye Bolt OR70
3. Insulator ISI-TWE-A35-70SB
4. Ball socket BS70
5. Anchoring clamp SL1613ALM

SUSPENSION

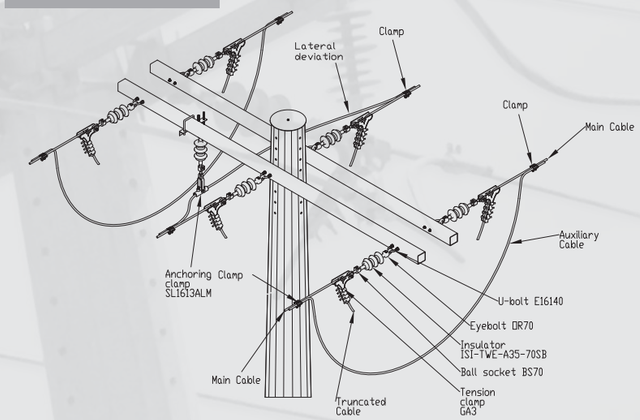
CONDUCTOR STRINGING TYPICAL CONDUCTOR INSTALLATION

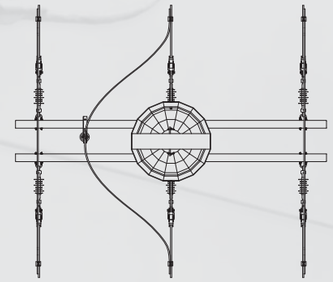
First Solution



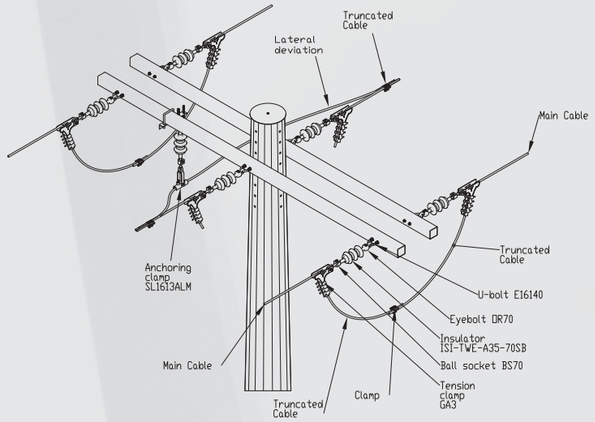


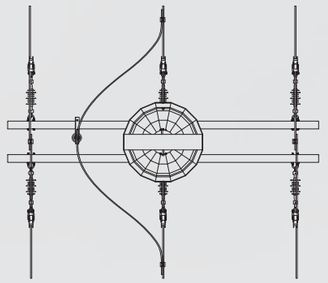
Second Solution





Third Solution



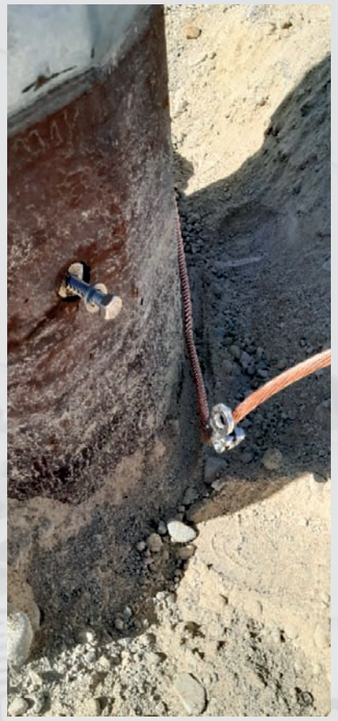


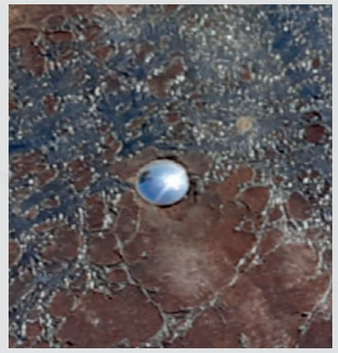
DPOLE CONDUCTORS STRINGING

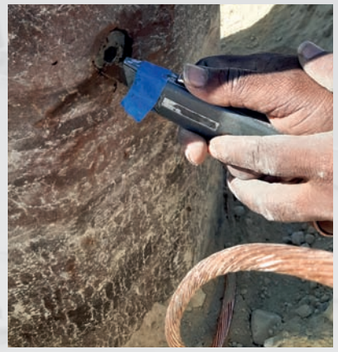
DPOLE EARTHING

Excavation and copper bar installation

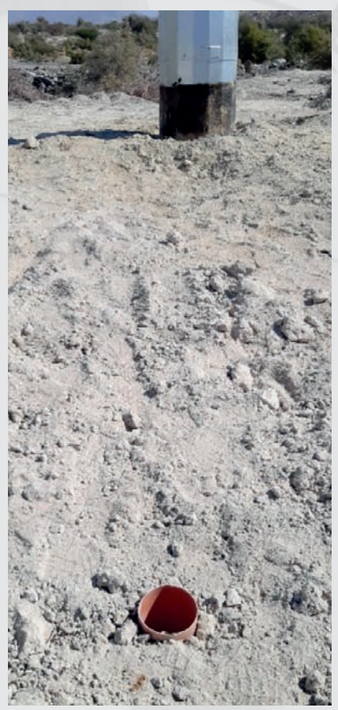
Copper cable installation







Earthing plugin stallation the pole



Finishing and connections

DPOLE PROJECT IN OMAN
(33KV LINE IN NIZWA)

DPOLE GROUND EMBEDMENT

POSITION	DESCRIPTION	POSITION	DESCRIPTION
(0.00)	Conventional indication of the ground level	A	Height of the earthing 300 mm
H	Total height of the hole* 3500 mm	C	Height heat-shrink sleeve 400 mm
B	Embedment heat-shrink sleeve 400 mm	Db	Hole diameter for the placement of the shaft= 1040 mm

** The depth shall be checked before of pole installation and in any case approved by the project manager.*

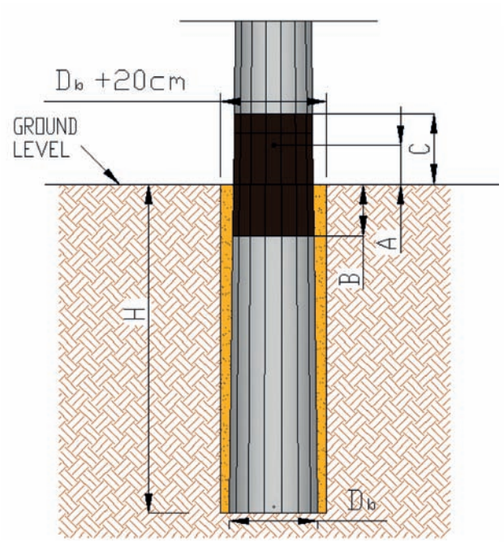


Figure: Reference quotes for the embedment

POSITION	DESCRIPTION	POSITION	DESCRIPTION
1	Anti - embedment plate	A	Foundation Hole
2	Base shaft of the pole	B	Ready shaft for the embedment
3	heat-shrink sleeve	C	Embedded and vertically placed shaft
4	sand with vibrating systems	D	Finishing with vibrated and compacted sand and Seal with a cement mortar collar

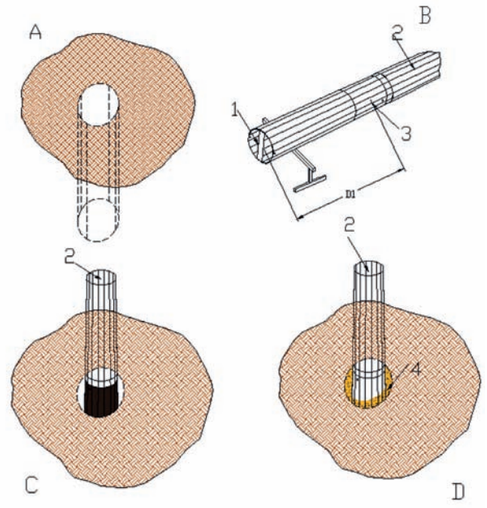
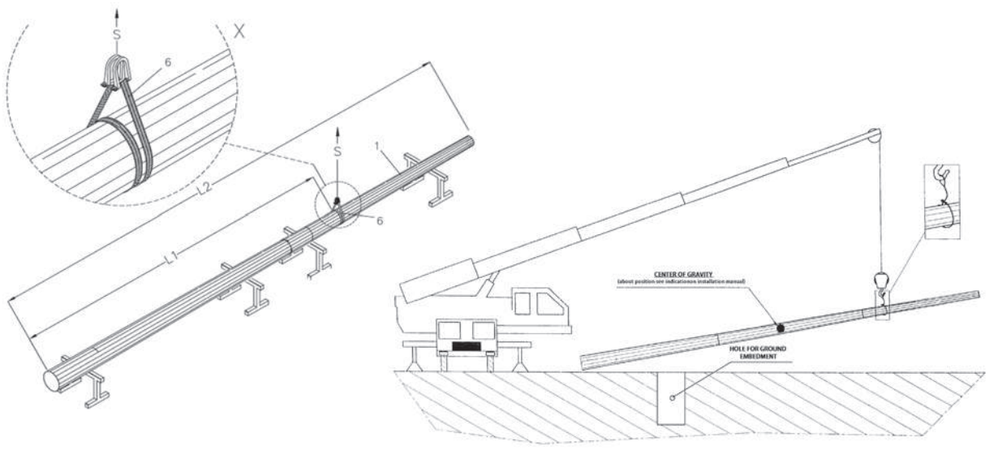


Figure: Embedment scheme of the pole shaft



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