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LINE TRAPS



INTRODUCTION

Fast and reliable data transmission is of extreme importance in the control and operation of electric power networks and different systems can be used to achieve this. One of the most economical and widely used methods of communication is to transfer the data at a high frequency using the main power circuit. This is usually called Power Line Carrier (P.L.C.).

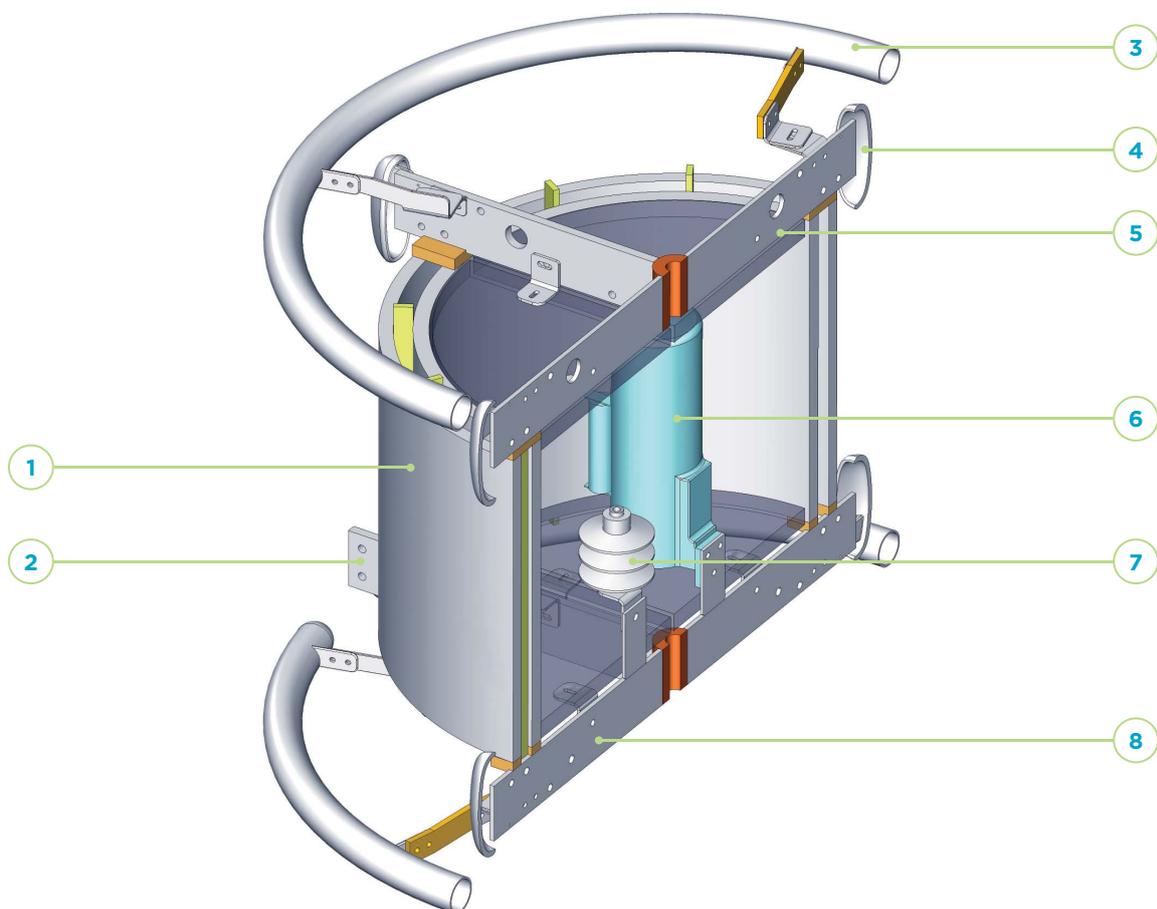
In conjunction with a coupling capacitor, they act like a filter to divert HF signal to/from telecommunication equipment and power frequency signal to/from substation.

Line Traps are connected in series with the transmission lines. They are designed to present high impedance to the HF signal, and very low impedance to the power frequency.

Line Traps up to 800 kV.

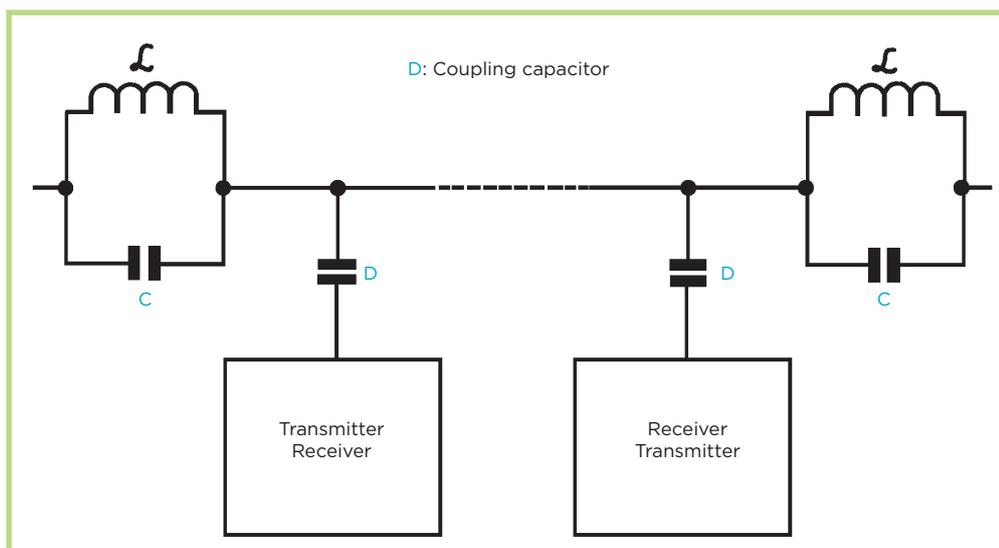
SECTIONS

- | | |
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| <ol style="list-style-type: none"> 1. Main coil 2. Terminal 3. Corona ring (optional, depending on system voltage) 4. Corona cap (optional, depending on system voltage) | <ol style="list-style-type: none"> 5. Bird barrier (optional) 6. Tuning pack 7. Surge arrester 8. Winding spider (cross arm) |
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APPLICATIONS

- › Line Traps are used in power line communications to prevent undue loss of carrier signal power and to minimize interference from carrier signaling systems on adjacent transmission lines.
- › They are inserted in series in a power transmission line in order to confine the high frequency carrier signal to the appropriate line sections.
- › They present high impedance at the carrier frequency band (40 to 500 kHz) thus preventing signal power loss. In addition, the impedance at the power frequency (50 or 60 Hz) is negligible, in order to avoid interfering with the power transmission.



- › Principle scheme of the insertion of Line Traps in a high voltage line.



- › Post mounted Line Trap.

DESIGN AND MANUFACTURE

Line traps must present high impedance at the PLC frequency, blocking this signal while the impedance to the power system frequency (50 Hz to 60 Hz) should remain as low as possible not to affect the operation of the system.

Frequency bands covered by line traps are between 50 kHz and 500 kHz. Legislation and local administration may partially restrict the use of some frequency bands within the range from 50 kHz to 490 kHz to prevent interferences with other communication systems.

High voltage lines usually have very high short circuit currents. Since the Line Traps are connected in series with the line, these high currents produce extreme mechanical forces within the main coil of the line trap. The line traps should therefore be capable of withstanding such forces as well as switching and lightning impulse voltages, thermal overloading and any other environmental or mechanical circumstance the line might be subjected to.

Line traps have three main components: the main coil, the tuning pack and a surge arrester, and some other accessories that can be used if required.

MAIN COIL:

The Coil is the main component of the line trap. Arteche Line Trap coils are manufactured by Coil Innovation, a world leader in air-core reactors.

ARTECHE line traps comprise a main coil, wound from stranded aluminium cable which is designed and rated in accordance with the maximum current of the system.

The stranded aluminium cable is normally, continuously wound, in one layer. If more than

one layer is required, separation between layers is achieved by means of spacer bars of epoxy resin and fibreglass. The spacing bars provide a cooling duct between winding layers.

Windings of the line traps are encapsulated in a continuously wound fibreglass filament impregnated with epoxy resin. Both ends of the winding are connected to an aluminium spider.

All main coil connections, spiders and main terminals are welded whereas the tuning box and lightning arrester are secured by means of bolts or screws.

Due to the complex mathematical formula involved in defining the constructive size and general coil arrangement calculations are carried out by means of computer aided designs.

ARTECHE line traps are designed for F temperature class as per IEC 60353.

SURGE ARRESTER:

It is designed to operate at impulse levels according to a proper insulation coordination, avoiding false operations triggered by overvoltages during short-circuits.

These surge arresters are designed for correct operation within the electromagnetic influence inside the line trap. They are metal-oxide type with a standard discharge current of 10 kA (other options also available on request).



- Line Trap mounted on a CVT.
- Suspension mounted Line Trap.

TUNING PACK:

The tuning device is connected in parallel with the main coil. It consists of inductors, capacitors and resistors which, together with the inductance of the main coil, adjust the circuit to a resonant frequency (f_{cN}) with minimum blocking impedance/resistance (Z_{bN}/R_{bN}) within a band of frequencies (Δf_{aN}).

This tuning provides a clear signal transmission with a loaded or unloaded H.V. line. These elemental inductors, capacitors and resistors are enclosed in an insulated box that provides mechanical support and is fixed to the main body, making it an extremely reliable unit.

The tuning unit design and adjustment is made by advanced calculation software due to the different parameters to be considered.

TUNING OPTIONS:

Single frequency tuning and double frequency tuning

Single frequency tuning is used when there is only one communication channel on the high voltage transmission line. This is the easiest tuning option, but it is only feasible when a narrow blocking range is required (Fig. 1).

Wideband tuning

Wideband line traps are suitable for multi-channel applications producing a broad frequency range, defined according to the electrical system values (Fig. 2).

Field adjustable tuning

It is possible to supply a line trap with a tuning pack that can be adjusted at site. This is required when there is a need to modify the frequency band after delivery or installation.

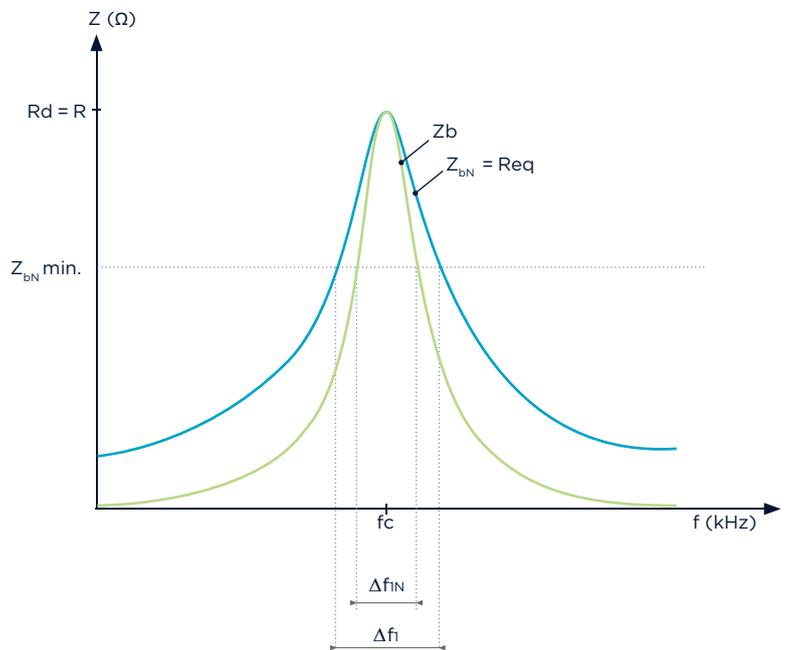
Self tuned line trap

These line traps don't need tuning devices, since the bandwidth is given just with the electrical characteristics of the main coil. This is only possible for some high inductance line traps.

ACCESSORIES

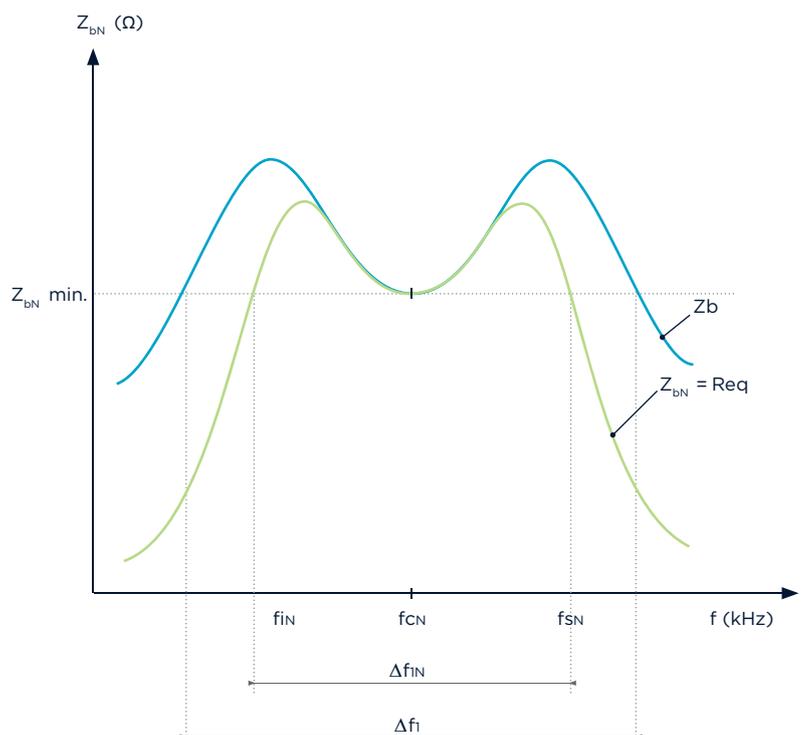
Terminals

Standard terminals are flat palm or stud type with size in accordance with the main coil rated current, following applicable standards.



Note: It is also possible to obtain, due to coupled resonant circuit properties, two separate tuning curves, with only one main coil, which is known as double frequency tuning.

› Fig. 1: Single frequency tuning curve.



› Fig. 2: Wideband tuning curve.

Bird Barriers

ARTECHE does not recommend the use of bird barriers since they don't give any advantage to the Line Trap performance. However, if requested, all the Line Trap models are designed to incorporate bird barriers without affecting the characteristics of the line trap.

Mounting

ARTECHE Line Traps have different mounting options:

- › Suspension:
 - Single point: It is single standard eye nut located in the centre of the main coil arms, available for the lighter models only.
 - Multiple point: There are multiple brackets attached to the spider in order to be hanged from isolators.
- › Pedestal:
 - On top of CVT: Line trap can be mounted on top of a coupling capacitor or a capacitive voltage transformer by an aluminium support structure specially designed to withstand the weight and the electromagnetic fields. This support structure can be delivered on request.
 - On top of insulators: Several insulators can be used to support the line trap on top of the post insulator(s). This can also be delivered on request.

FEATURES

- › It provides a maximum reliability communication channel for the substation control and protection due to its durability.
- › Highly reliable tuning system.
- › High mechanical resistance to short-circuit stresses.
- › Compact size, due to Coil Innovation state of the art design, providing better seismic performance and lower wind resistance.
- › Maintenance free.
- › Wide range of tuning devices suitable for several tuning alternatives: narrow, broad or adjustable band.
- › Different mounting configurations (suspended, on top of CVT, on top of insulators).
- › Wide range of primary terminals.

› Suspension mounted Line Traps.



RANGE

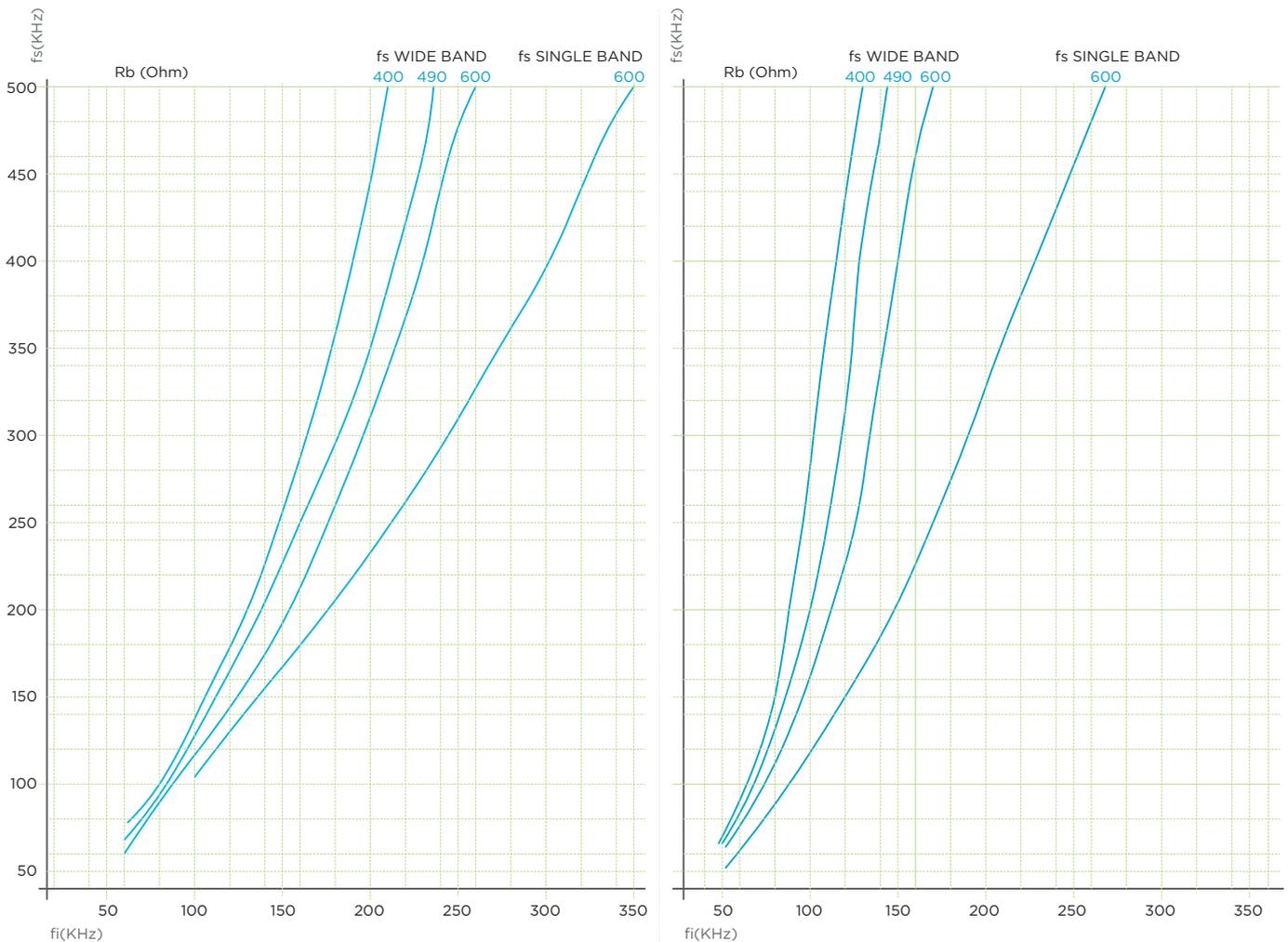
As per IEC 60353

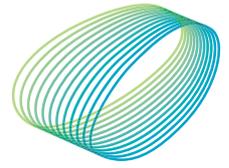
Continuous rated current (A)	Short-time series I (kA/1s)	Short-time series II (kA/1s)	Rated inductance at 100 kHz (mH)				
			0.2	0.315	0.5	1.0	2.0
400	10	16	0.2	0.315	0.5	1.0	2.0
630	16	20	0.2	0.315	0.5	1.0	2.0
800	20	25	0.2	0.315	0.5	1.0	2.0
1,000	25	31.5	0.2	0.315	0.5	1.0	2.0
1,250	31.5	40	0.2	0.315	0.5	1.0	2.0
1,600	40	50	0.2	0.315	0.5	1.0	2.0
2,000	40	50	0.2	0.315	0.5	1.0	2.0
2,500	40	50	0.2	0.315	0.5	1.0	2.0
3,150	40	50	0.2	0.315	0.5	1.0	2.0
4,000	63	80	0.2	0.315	0.5	1.0	2.0

Other ratings available on request.

ANSI C93.3 ratings available on request.

Sample of wide and single band frequency blocking range of 0.2 and 0.5 mH Line Trap





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Moving together