

# Frangible Masts by AmpliSafe®



**indra**

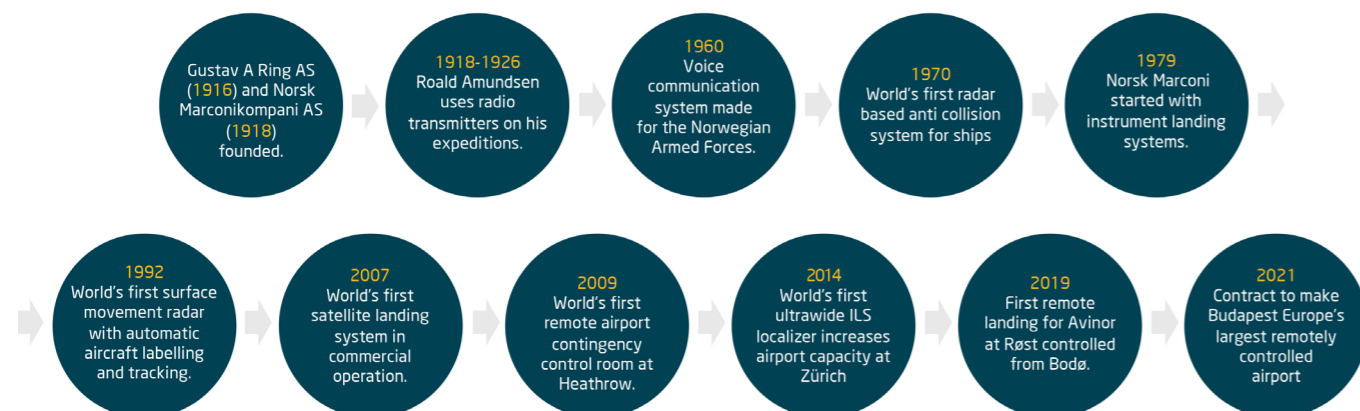


# This is Indra in Norway

Indra is one of the leading global technology and consulting companies and the technological partner for core business operations of its customers worldwide. Its 56 000 employees serve clients in over 140 countries within the transport, defense and IT markets.

In Norway, Indra is dedicated to **air traffic management technology**. We design, produce, integrate and support airport communication, navigation and tower systems. Our highly customized solutions deliver outstanding long-term value under the most demanding conditions. More than 1 500 airports around the world rely on our **Normarc, InNova and Garex** products.

## Company history



Frangible Masts by AmpliSafe® is a product family of frangible aluminium-masts, offered by Indra in cooperation with Normeka.

Normeka is a subsidiary of Indra, and has manufactured equipment for localizer and Glide Path systems for airports since 1980 - mainly as a sub-supplier to Indra. Normeka is a full service mechanical subcontractor with a focus in manufacturing aluminium products.



# Frangibility

At an airport, there is a lot of equipment that is necessary in order for operations to be carried out successfully.

The problem is that the masts often used to elevate this equipment are a possible hazard to any airplane which, for any reason, is off course. In order to reduce the possibility for accidents it has been decided that masts that might be hit by an aircraft during takeoff/landing/taxiing must be frangible to the greatest extent possible.

## Definition of Frangibility

ICAO Doc 9157 AN/901 – “Aerodrome Design Manual, part 6, Frangibility” defines frangibility. A frangible object should have low mass and be designed to break, distort or yield on impact. This can be verified by FEA (Finite Elements Analysis) or full-scale testing. Certain criteria have to be met in order to claim that a structure is frangible. Survival wind 55 m/s.

Frangible Masts by AmpliSafe®, have been simulated and verified by the Swedish company, DYNAmore Nordic AB.

The conclusion is that the Frangible Masts by AmpliSafe® fulfill the requirements given in the above mentioned ICAO document, and the masts are considered frangible.

Due to the fact that ICAO requirements for testing of frangibility is based on more than 20 years old documentation, and that the computer simulation technology now is significantly better, Normeka has decided that Finite Element Analysis (FEA) is the preferred method for testing of frangibility performance.

This method is widely recognized by frangibility experts internationally.

*Dr Thor Breien*  
Senior Product Advisor Navigation, Indra Navia AS

*Gunstein Arnesen*  
Technical Manager, Normeka AS

## Description of Frangible Masts by AmpliSafe®

Frangible Masts by AmpliSafe® are:

- UV resistant
- Not affecting radio aids signals
- Maximum height 17.09 m
- Fixing rods, washer and nuts on hot galvanized steel 8.8 grade

Frangible Masts by AmpliSafe® can be used in many applications such as approach lights, antennas, meteorological equipment, wind socks etc. The mast itself will be the same, but the interface between the mast and the equipment will be tailor-made, and they are made in four different sizes. The size of the mast is determined by:

- the height of the mast
- the equipment (size, weight) to be mounted in the mast







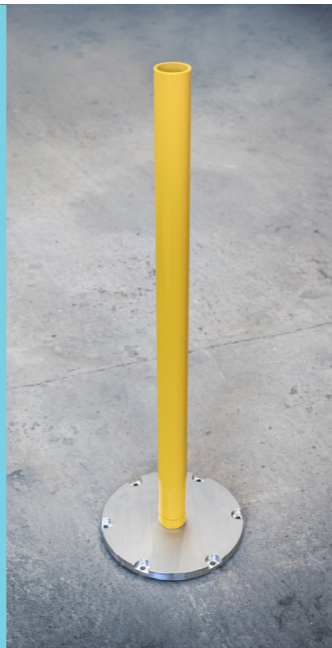
Solutions become more powerful if you can extend the capabilities of the components, or if you can make them behave or interact in new ways.



# The frangible structures

## AP

This is a tube mast for single lights. The tube has a breakable section at the bottom, and can be fitted directly into baseplate with 2inch. threads. It will eliminate the need for breakable coupling, and can be delivered up to 1800mm tube.



## 3M

Triangular mast, with a slightly larger sidewall: 240mm. Used as a base for the 3S when one or two approach lights shall be mounted on a mast up to 10m. The bottom section will then be a larger 3M and the upper section will be the smaller 3S.



## 3S

This is the smallest mast, it has a triangular cross-section where the side-wall is 195mm. This mast is generally used for one or two approach lights (or similarly sized equipment), the mast can be delivered in heights up to 6.6 m.



## 4M

Square mast, with a slightly larger sidewall: 240mm. Used as a base for the 4S when the requested height of square mast exceeds 7m. Maximum height for the combination 4M and 4S is 13m. 4M (4L) in combination as a bottom section together with 4M and 4S can reach heights up to 17m.

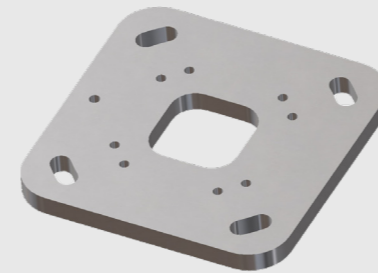


## 4S

This is the smallest mast with square cross section, sidewall is 195mm. This mast is normally used as a moderate tall mast with more than two lights or as the top section when combined with 4M. It is used for up to five approach lights (or similarly sized equipment), the mast can be delivered in heights up to 7m.

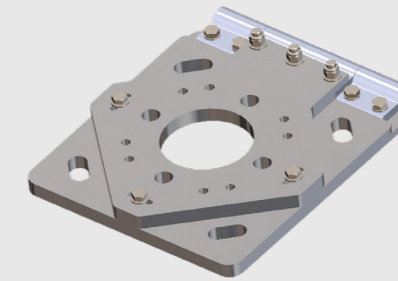


# Description of aluminium accessories



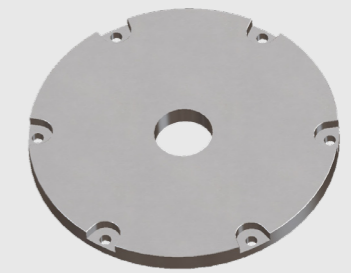
## Base plate

Each mast is supplied with a base plate mounted to the lower end. The base plate is made of aluminum. 3 holes (triangular masts) or 4 (square masts) will be used to mount the mast to the foundation. The base plate is made of aluminum and there are 4 unique base plates to the 4 mast types.



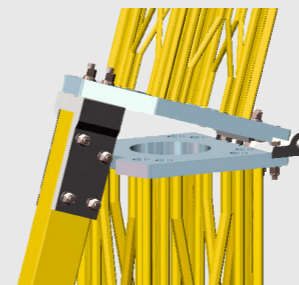
## Base plate with hinge

Normally the base plate is fixed, but it can be supplied with hinge. The hinge will ease the maintenance of the equipment mounted in the top of the mast because it is possible to swing down the mast. Thus no climbing or lifting is needed.



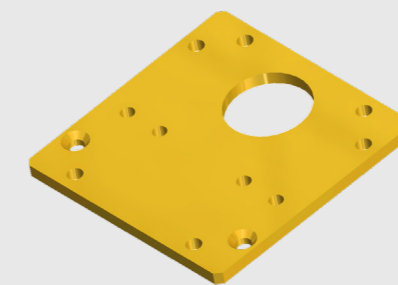
## Baseplate AP

Baseplate for AP can be delivered in 8" and 12" with 2inch threads.



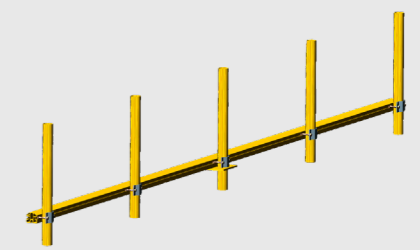
## Hinged connection plate between M and S mast

Some customers will have easy access to masts with a lift. In such cases, it will be cheaper to supply a mast without a middle hinge, only a connection plate.



## Top plate

The top plate will always be mounted on top of the mast. Its geometry will depend on the actual equipment which the customer wants to place in the top of the mast. This will be manufactured according to customer specifications.



## Crossbar

A special profile might be mounted horizontally on top of the mast. The mast itself is very stable, and when mounting a crossbar (which can hold up to 6 lamps, and be up to 5,5 m long) the number of masts can be kept as low as possible. Vertical Ø60 aluminum pipes are mounted to the horizontal traverse, each of them holding one lamp.





### Typical configurations of approach lights

When using the masts in different configurations we are able to deliver mast systems that will accommodate any light manufacturer, wind cone manufacturer, meteorological equipment and approach requirements.

# Technical specifications of main components

Description	Size	Weight	Material
3S mast	Sidewall 195mm	5,8kg/m	Aluminum 6063
3S footplate	Triangular	2,9kg	Aluminum 6082
3S footplate w/hinge		6,7kg	Aluminum 6082
3S top-plate		1,0kg	Aluminum 6082
4S mast	Sidewall 195mm	7,7kg/m	Aluminum 6063
4S footplate	Square	5,2kg	Aluminum 6082
4S hinged footplate		8,9kg	Aluminum 6082
4S top plate		1,4kgw	Aluminum 6082
3M mast	Sidewall 240mm	11,1kg/m	Aluminum 6063
3M footplate	Triangular	5,9kg	Aluminum 6082
3M-3S middle hinge		9,2kg	Aluminum 6082
3M top plate		2,0kg	Aluminum 6082
4M mast	Sidewall 240mm	14,3kg/m	Aluminum 6063
4M footplate	Square	9,0kg	Aluminum 6082
4M-4S middle hinge		9,4kg	Aluminum 6082
4M top plate		2,5kg	Aluminum 6082
AP tube	Ø60 mm x 150-1800	1,2kg	Aluminum 6060
Base plate AP 8"	Ø 8 inches	1,9kg	Aluminum 6082
Base plate AP 12"	Ø 12 inches	4,4kg	Aluminum 6082
Top traverse (for mounting > 1 lamp/mast)	Max length 5500mm	3,55kg/m	Aluminum 6060
Light fitting pipe	Ø60 mm x 700	1,2kg	Aluminum 6060

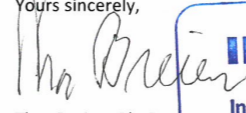
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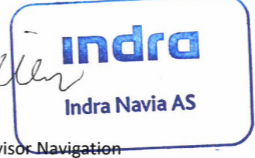
**No effect of AmpliSafe aluminum approach light structures on Instrument Landing Systems (ILS) performance**

Indra Navia, the world's largest exporter of Instrument Landing Systems (ILS), have never experienced or are aware of negative effects of such masts on the ILS signal performance.

ILS signal are horizontal polarized. That means vertical metal structures, like light masts, have no effect on the ILS signals.

Horizontal light bars are always installed symmetrically with respect to the approach line. Hence, such bars will not affect the ILS guidance signals.

Yours sincerely,  
  
**Thor Breien, Ph. D.**  
 Senior Product Advisor, Navigation  
 Indra Navia AS





# Creating skies together

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