

**System solutions for the handling of pellets - larger plants**







## MAFA knows how to handle pellets



Mats Andersson  
MAFA, Ängelholm

*"For 50 years, MAFA in Ängelholm have constructed and produced equipment for the handling and storage of bulk products. When fuel pellets for heating first became a reality roughly 12 years ago, we had a head start.*

*Today, we are the market leader in Sweden and more than 50% of our production is for export. To date, we have delivered more than 50,000 silos and containers for fuel pellets.*

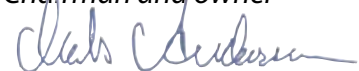
*A fuel pellets system must be designed to function reliably for many years. We offer expertise and service of the highest grade, and have over many years, developed system solutions that not only function well, but are easily adapted to integrate into existing surroundings. Some of these are shown further in the brochure.*

*By moving over to heating with fuel pellets, a domestic renewable raw material which is environmentally friendly, you are not only making a positive contribution to your country's balance of trade, but one that is beneficial to the future of the environment.*

*Contact us or your local representative for pellets materials and insist on MAFA - equipment, you deserve it.*

*We know how to handle fuel pellets like nobody else."*

Chairman and owner





# Heating with fuel pellets - a renewable raw material



*Fuel pellets are manufactured from by-products from the timber and milling industries.*

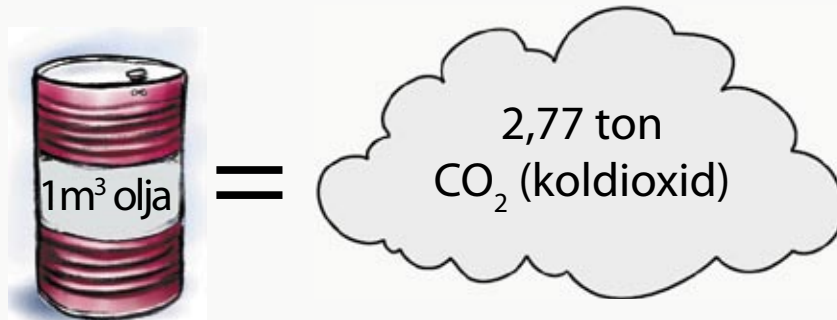
We face an increased environmental threat, that is what all the experts are agreed on, and the fact you are reading this brochure indicates to us that you too, take the threat to our environment seriously.

Fossil fuels exacerbate the greenhouse effect. Carbon dioxide (CO<sub>2</sub>) increases causing acid rain, which in turn pollutes the soil and lakes. Sulphur and nitrogen oxide is created which is harmful to humans, animals, and vegetation. In addition, heavy metals such as cadmium, lead, and mercury are released.

However, because bio-fuels are carbon neutral, they don't influence the greenhouse effect as natural carbon dioxide is a part of the cycle. By choosing pellets you get a natural home-produced, renewable and environmentally friendly raw material, with low emissions and low water content. Low investment and fuel costs are another plus.

Heating with fuel pellets is safe, convenient, uses simple firing techniques and offers a safe fuel supply. Furthermore, fuel pellets use little storage space, are easy to transport and have a high heat output.

1 m<sup>3</sup> oil discharges the equivalent of 2.77 tons CO<sub>2</sub> (carbon dioxide).



Bio-fuel releases 0 kg CO<sub>2</sub>. About 2.1 tons pellets to 1m<sup>3</sup> of oil are used. Pellets have an energy rating of 4.8 kWh/kg.





# MAFA's System Solutions are built on 50 years experience of bulk handling



*A lorry bulk delivers 12 tons of pellets, and with a trailer, 32 tons of pellets.*

The sum of the parts makes up a whole. If the plant is to fulfil its function and the client's needs, everything must work in harmony. Every construction is unique and is adapted to suit the customer's heating equipment and the location of the pellets silo.

The choice of silo is based on the size of the heating system and the characteristics of the building. The choice of a pellets system is different for every burner/brand because they all function differently. MAFA have been co-operating with its suppliers of heating equipment for many years. MAFA have a range of pellet containers from 50kW -1.5 MW and have gained a wealth of experience over the last 10 years.

Below are some rule of thumb guidelines to make your choice of silo easier.

## **Choosing the right size of silo**

### **Standard value of a pellets burner/boiler (based on yearly oil consumption):**

15 m<sup>3</sup> oil equivalent to 50 kW burner = 31 tons → 48 m<sup>3</sup> pellets  
30 m<sup>3</sup> oil equivalent to 100 kW burner = 63 tons → 97 m<sup>3</sup> pellets  
100 m<sup>3</sup> oil equivalent to 300 kW burner = 210 tons → 323 m<sup>3</sup> pellets  
330 m<sup>3</sup> oil equivalent to 1 MW burner = 693 tons → 1066 m<sup>3</sup> pellets

### **Recommended silo for burner output:**

With a 50 kW pellets burner, a silo of at least 12 m<sup>3</sup> should be used.  
With a 100 kW pellets burner, a silo of at least 25 m<sup>3</sup> should be used.  
With a 300 kW pellets burner, a silo of at least 40 m<sup>3</sup> should be used.  
With a 750 kW pellets burner, a silo of at least 85 m<sup>3</sup> should be used.  
With a 1 MW pellets burner, a silo of at least 127 m<sup>3</sup> should be used.

The choice of silo depends on the bulk delivery (quantity of pellets supplied) and having sufficient stock for holiday periods (e.g. Christmas and New Year).

### **Number of fillings per year with the right choice of silo:**

50 kW burner and a 12 m<sup>3</sup> silo = 4-5 times/year  
100 kW burner and a 25 m<sup>3</sup> silo = 4-5 times/year  
300 kW burner and a 40 m<sup>3</sup> silo = 8-9 times/year  
1 MW burner and a 127 m<sup>3</sup> silo = 8-9 times/year

Painted MAFA XB 148 silo (148 m<sup>3</sup>) Revingehed.









Painted MAFA Outdoor Module silo (34.2 m<sup>3</sup>) at Gullbrandstorp school.

# MAFA's System Solutions are suitable for all surroundings

If you invest in a MAFA bio-fuel plant there is also the option to integrate it with the building.

The silo is an important part of the system, and extra care should be taken when choosing silos for use in public areas and rented properties. Equally important is a good location and harmonization with existing surroundings. Is the silo to be placed inside or outside? Will it be free-standing or built-in? Is the immediate vicinity especially sensitive to environmental consideration? Is it advantageous if the silo is purpose-built, painted, or built-in?

The questions are numerous, and furthermore, the plant must continue to function regardless of climatic or temperature changes. It should also require little maintenance, and ought to have an in-built warning system to prevent any undesirable interruptions to the plant's operation.

A MAFA silo is supplied with a sensor that warns against overfilling, and a ventilation flue (MAFA cyklon) for natural ventilation, giving condensation-free storage. Safe transfer of pellets to the burner is controlled electronically. This ensures that everything functions as it should.

The whole plant only needs a little attention now and again to function well, and all silos are tested for reliability. We recommend the silo is ordered ready-assembled from MAFA.

## Choosing the right MAFA silo model:



### MAFA round Unik silo:

Where possible, a cylindrical silo should be used. They are stable, safe in operation, and easy to empty and fill. As standard they come complete with MAFA's natural ventilation system, can be painted, and the bottom section can be fitted with cladding. A wide range of sizes and models are available from 6m<sup>3</sup> to 189 m<sup>3</sup>, and as they are built for height, they occupy little space. Round silos are for external use only and require planning permission.



### MAFA Module silo:

For indoor and outdoor use. Generally not as tall as the Unik range. Can be painted and the bottom half fitted with cladding. Available in a range of sizes and models. Built for height and outdoor models require planning permission.



### MAFA Succé BIO:

For indoor and outdoor use. Easy to assemble, build-in, clad, and can be painted. The silo is modular and can easily be extended both in height and length. Available in a range of sizes and models from 5 m<sup>3</sup> to 34 m<sup>3</sup>. Easy to use, suitable for plants up to 400 kW.

Energy engineer Claes-Uno Widerfors, C4-Teknik, Kristianstad local authority:

*“We have helped the environment and simultaneously reduced our fuel costs by 35 million kronor over the last seven years”*



Energiingenjör  
Claes-Uno Widerfors,  
C4 Teknik,  
Kristianstads kommun.

Kristianstad Local Authority has for many years now, been one of the leading districts in Sweden when it comes to the environment. In the beginning of the 1980's they were already testing bio-fuels for heating. New environmental goals were set for the district in 1998. C4 Teknik is the Local Authority's technical administration and is answerable for the road network, property, water and waste.

It was also C4 Teknik that managed the first investment of 23 bio-fuel plants completed in 1999. At first it was properties such as schools, homes for the elderly, and other similar buildings which couldn't be supplied with district heating, that became the focus for renovation to enable heating with fuel pellets.

During 2000-2001, roughly 20 plants were built. By 2007, a further two were completed and many more properties were connected to the centrally fired pellet burners. There are now a total of 45 pellet plants within the district.

The person responsible for investing in bio-fuels has been Claes-Uno Widerfors, Energy Engineer, while his co-worker Stig Olsson, has been answerable for economic research.

When the pellet plants were purchased, the local authority and Claes-Uno had the roll of main contractor. MAFA in Ängelholm were one of the chosen subcontractors that contributed to the whole project with their experience and expertise in storage silos and auger solutions.

C4 Teknik has more than seven years experience in environmentally friendly heating, and by moving over to pellet fired systems have eliminated 1,000 m<sup>3</sup> of oil per year. Today less than 100 m<sup>3</sup> is used for heating. Besides the big environmental gains of a reduction of emissions by 2,770 tons of CO<sub>2</sub> per year, savings of over half a million Euro per year (2008 price levels) in reduced fuel costs have been achieved, i.e. a total of almost 4 million Euro.

It's not only through heating plants that Kristianstad Local Authority has an interest in environmental ventures. All of the town's local buses run on bio-gas, as do most of the district's own vehicles. The supply of bio-gas is produced at their own plant in Karpalund. Everyone in the district is also encouraged to be more environmentally aware and to try and minimize the effect they have on the habitat. In addition, Kristianstad Local Authority has now extended their district heating network.

C4 Teknik has a unique expertise of heating with pellets. Today nearly all monitoring of the heating plants is computerised. Of the existing 45 pellet plants about 1.8 million Euro has been invested, while costs for district heating has been over 5 million Euro.

In recent years Kristianstad has received many awards, among others from the EU, for its determined and long term approach on environmental awareness and for its endeavours on behalf of the district and its inhabitants.



MAFA Succé silo BSM 626 (19,5 m<sup>3</sup>) at Hammar green house in Kristianstad.



Claes-Uno Widerfors and Stig Olsson beside two built-in Succé BSM 536 silos (2x25.3 m<sup>3</sup>) at Tollarp school.



# More examples from residential areas, districts and industry that have benefited by investing in the integration of existing surroundings



Painted MAFA BIB 58 silo (57.7 m<sup>3</sup>), Ullånger.



Painted MAFA outdoor module silo (34.2 m<sup>3</sup>), Eldsberga school.



Painted MAFA BIB 67 silo (66.9 m<sup>3</sup>), at Veinge school.



Painted MAFA BIB 85 silo (85.2 m<sup>3</sup>) at Helledals school in Ramvik.



MAFA Succé BSM 631 silo (24.9 m<sup>3</sup>), at the garden center in Förlöv.



MAFA outdoor module silo (28.9 m<sup>3</sup>) at Strömsholm school.







# MAFA has a pellets silo for every heating need



MAFA Succé BIO 5-34 m<sup>3</sup>

MAFA offer a wide range of silos. They are tested and reliable and can be ordered as supply only or assembled. A factory-assembled silo is delivered to site by a lorry equipped with a crane and then erected on a pre-made concrete base.

## MAFA Succé BIO - low built silo

The BIO silo comes in lengths of 2, 3, 4 and 5 sections (2.46 - 6.15 m), in heights between 1.99 and 3.91 m, and a width of 1.88 m (5.2 - 34.2 m<sup>2</sup>).

Manufactured in maintenance free aluzinc sheet complete with filling pipe, air pressure outlet with dust filter, inspection hatch, incl. viewing glass endbearing and overfilling level sensor. Supplied unassembled or factory assembled.

MAFA Unik Small  
UNS 6.3-11.5 m<sup>3</sup>



## MAFA Unik Small UNS - round silo with diameter 1.88 m

The UNS silo comes in heights between 5.33 m and 7.27 m (6.3 m<sup>3</sup> - 11.5 m<sup>3</sup>). Manufactured in maintenance free aluzinc sheet complete with filling pipe, long 90° bend pipe, filling through the ventilation flue, special cone for separation free emptying, and view glass. Excl. shut-off tray and hopper. Delivered supply only, or factory-assembled with 7 years guarantee.

MAFA Unik UN  
12.0-37.8 m<sup>3</sup>



## MAFA UNIK UN - round silo with diameter 2.34 m

The UN silo comes in heights between 6.45 m and 12.45 m (12 m<sup>3</sup> - 37.8 m<sup>3</sup>). Manufactured in maintenance free aluzinc sheet complete with filling pipe, long 90° bend pipe, filling through the ventilation flue, special cone for separation free emptying, and view glass. Excl. shut-off tray and hopper. Delivered supply only, or factory-assembled with 7 years guarantee.

MAFA Unik BIB  
21.1-85.2 m<sup>3</sup>



## MAFA BIB - round industry silo with diameter 3.10 m

The BIB silo comes in heights between 6.95 m and 15.35 m (21.1 m<sup>3</sup> - 85.2 m<sup>3</sup>). Manufactured in maintenance free aluzinc complete with filling pipe, long 90° bend pipe, filling through the ventilation flue and a cone with a smooth internal face that facilitates self-emptying. Provided with special round headed bolts and view glass. Excl. shut-off tray and hopper. Delivered supply only, or factory-assembled with 7 years guarantee.

MAFA XB  
86.1-189.30 m<sup>3</sup>



## MAFA XB - round large silo with diameter 4.68 m

The XB silo comes in heights between 9.5 m and 15.5 m (86.1 m<sup>3</sup> - 189.3 m<sup>3</sup>). Manufactured in maintenance free aluzinc complete with filling pipe, long 90° bend pipe, filling through the ventilation flue and a cone with smooth internal face that facilitates self-emptying. Excl. shut-off tray and hopper, ladder and roof platform. Delivered supply only, or assembled on site.

## MAFA Outdoors module silo – square with 45° cone

An outdoors silo in sizes measuring 1.5x1.5 m, 2.05x2.05 m, 2.55x2.55 m and 3.0x3.0 m (1.7 m<sup>3</sup> - 50.0 m<sup>3</sup>). Manufactured in galvanized steel sheet. The silo is delivered with shut-off tray, filling pipe with long bend and cyclone. Outlet 0.3x0.3 m. Delivered supply only or assembled on site.

MAFA outdoor  
module silo  
1.7-50.0 m<sup>3</sup>



## MAFA indoors module silo – square with 45° cone

An indoors silo in sizes measuring 1.5 x 1.5 m, 2.05x2.05 m, 2.55x2.55 m and 3.0x3.0 m (1.2 m<sup>3</sup> - 83.0 m<sup>3</sup>). Manufactured in galvanized steel sheet. The silo is delivered with filling pipe, air pressure release through a spring-loaded cover and dust filter. Delivered supply only or assembled on site.

## MAFA indoors rectangular module silo

An indoors silo in sizes measuring 1.3x2.55 m, 1.55x2.05 m, 2.05x3.0 m and 2.55x3.0 m (3.6 m<sup>3</sup> - 41.3 m<sup>3</sup>). The silo is delivered with filling pipe, spring loaded air pressure release cover and dust filter. Delivered supply only or assembled on site.

MAFA indoor  
module silo  
1.2-83.0 m<sup>3</sup>



For more data on MAFA's range of silos, see our product leaflets on our web site; [www.mafa.se](http://www.mafa.se)

# Examples of MAFA's System Solutions

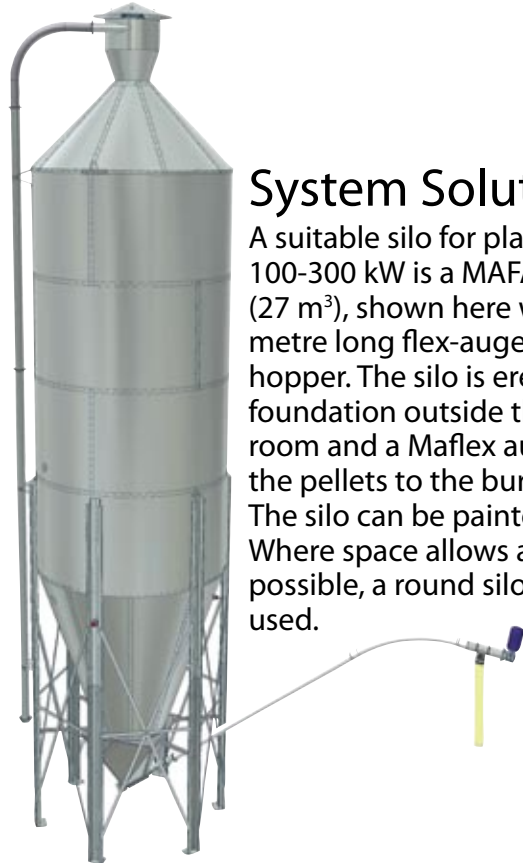
MAFA has taken some examples to show how a fuel pellet plant can be adapted to certain prerequisites and to fit in with existing surroundings. Irrespective of choice - if it's a transport auger or vacuum transport, with or without an intermediate hopper - a MAFA pellets system is flexible, reliable, and easy to run. The choice of system solution depends on the brand of burner.

System solutions can be a great help for clients working to a budget, or using a retail price guide (see the price list on our web site) for tendering or preparing a project.



## System Solution A

A suitable silo for plants between 50-100 kW is a MAFA Unik UNS 12 (12 m<sup>3</sup>), shown here with a seven metre long flex-auger from a 37° hopper. The silo is erected on a foundation outside the boiler room and a Maflex auger conveys the pellets to the burner/boiler. The silo can be painted. Where space allows and whenever possible, a round silo should be used.



## System Solution B

A suitable silo for plants between 100-300 kW is a MAFA Unik UN 27 (27 m<sup>3</sup>), shown here with a seven metre long flex-auger from a 37° hopper. The silo is erected on a foundation outside the boiler room and a Maflex auger conveys the pellets to the burner/boiler. The silo can be painted. Where space allows and whenever possible, a round silo should be used.



## System Solution C

A suitable silo for plants between 1.0-1.5MW is a MAFA XB 189 (189 m<sup>3</sup>), shown here with a four metre long, 4 inch auger from a 15-45° hopper. The silo is erected on a foundation outside the boiler room. Where space allows and whenever possible, a round silo should be used.



## System Solution D

A suitable silo for plants between 500-750kW is a MAFA BIB 85 (85 m<sup>3</sup>), shown here with a four metre long, 4 inch auger that is fed from an adjustable hopper between 15-45°. The silo is erected on a foundation outside the boiler room. Bottom section can be clad and the silo can be painted. Where space allows and whenever possible, a round silo should be used.





## System Solution E

A suitable silo for plants between 100-300 kW is a MAFA Outdoors Module silo (28 m<sup>3</sup>) with a seven metre long flex auger from a 37° hopper. In certain areas a square silo may be more suitable. Bottom section can be clad and the silo can be painted.



## System Solution F

A suitable silo for plants between 300-500 kW is a MAFA BIB 40 (40 m<sup>3</sup>), shown here with a five metre long flex auger from a 0° hopper. A good combination when the boiler room is located in the cellar. The silo is erected on a foundation outside the boiler room and a Maflex auger transfers the pellets to the burner/boiler. Bottom section can be clad and the silo can be painted.

Where space allows and whenever possible, a round silo should be used.

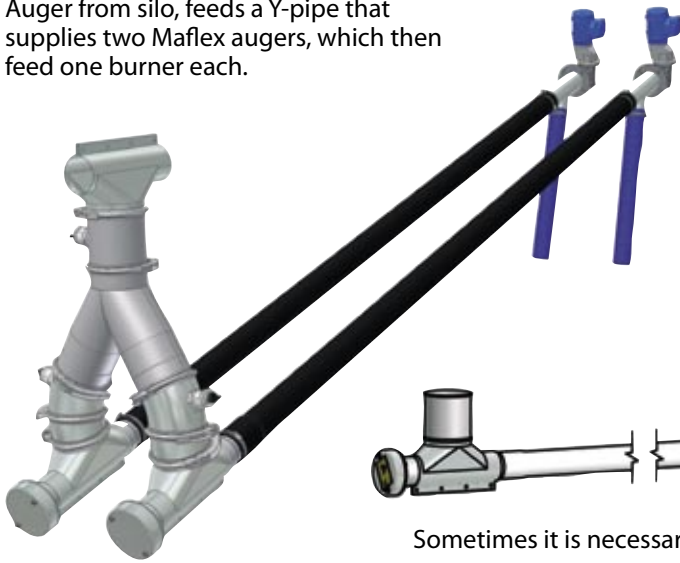
## System Solution H

When it's impossible to place a tall silo outdoors, the best option for plants between 100-300 kW would be a Succé BIO 530 (23,7 m<sup>3</sup>), shown here with a five metre long Maflex auger from a centre outlet. Succé can also be placed indoors and can be painted.

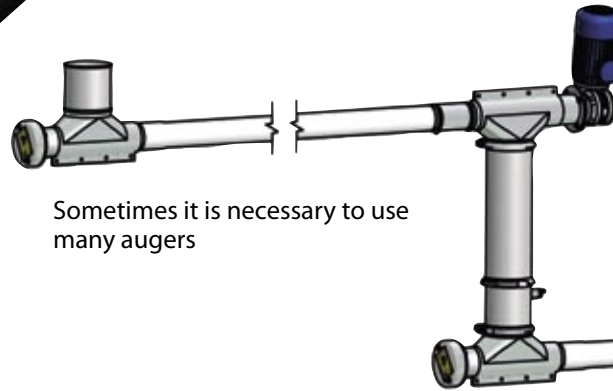


# Alternative examples of MAFA's feed systemsativ

Auger from silo, feeds a Y-pipe that supplies two Maflex augers, which then feed one burner each.



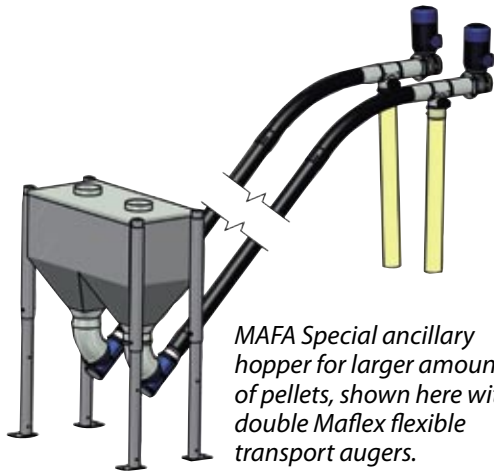
Auger to a drop pipe incl. start and stop sensor for the feed auger. A feed auger to the pellets burner is fitted underneath the drop pipe.



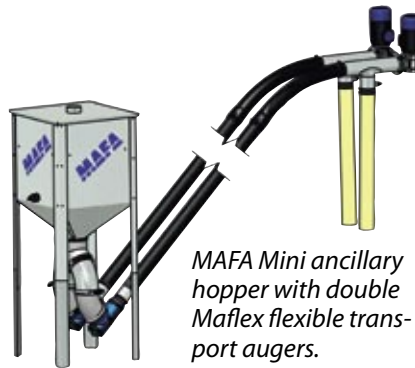
Sometimes it is necessary to use many augers

## Alternative outlets for System Solutions

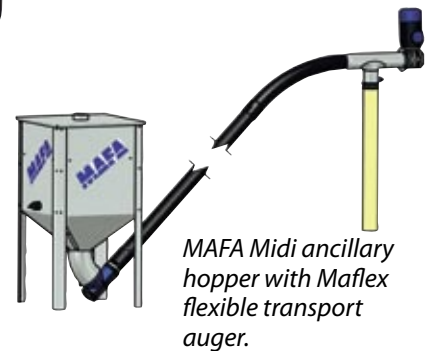
Sometimes it can be beneficial to incorporate an intermediate hopper before the pellets are fed to the burner.



*MAFA Special ancillary hopper for larger amounts of pellets, shown here with double Maflex flexible transport augers.*



*MAFA Mini ancillary hopper with double Maflex flexible transport augers.*



*MAFA Midi ancillary hopper with Maflex flexible transport auger.*

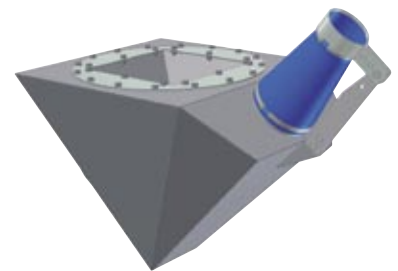
## Auger Hoppers



*MAFA 37° auger hopper designed for Maflex and 4" auger*



*MAFA 0° auger hopper designed for Maflex and 4" auger*



*MAFA adjustable 15-45° auger hopper designed for a 4" auger*

More accessories and equipment can be found on our web site; [www.mafa.se](http://www.mafa.se)



# Optional equipment



To enhance the functionality of MAFA's pellet fabrications, a number of supplementary tools and equipment is available to make the working day safer and easier.

## Access ladder and platform

A practical add-on for those who need to inspect the silo on a regular basis.

## Cladding and painting

Our silos can be delivered pre-clad from our factory. They can also be painted in colours which blend in well with the surroundings and be used to set off an organization's own colour scheme or logo.

## Silo door

A lockable silo door can be factory-fitted on silos with cladding to prevent unauthorized entry.

## Weighing

All MAFA silo models can be complemented with a weighing system which affords complete control of deliveries, status of stock and dosage.

## Site assembled

We offer an in situ supply and fix service. Smaller sized silos are factory-built, delivered to site, and then erected on a pre-made concrete base.

## Demonstration and tuition

MAFA can offer a working demonstration of a silo and auger equipment, and can also offer on site tuition for operations personnel.



## MAFA level sensor

Sometimes regulations require that storage silos are fitted with warning sensors. MAFA's level sensors warn against high and low pellet levels in the silo and any ancillary hoppers.



Torex level guard



Capacity sensor



Alarm lamp

Prices and more accessories and equipment can be found on our web site; [www.mafa.se](http://www.mafa.se)





# Do your own calculations on moving over to heating with fuel pellets

When calculating the initial set up and running costs on a fuel pellets plant, remember to use the following guidelines:

Output and storage size on page 7, MAFA's range of system solutions on pages 14 to 17, and the system solutions price lists on our web site for a description of the types of plant and usage and to help budget for your future fuel pellets plant.

When evaluating running costs, the following generally apply:

- 2.1 ton pellets for 1 m<sup>3</sup> oil.
- Fuel pellets cost about 170 €/ton and oil 791 €/m<sup>3</sup>.
- 1m<sup>3</sup> oil @ 791 € minus 2.1 ton pellets x 170 € (791€ - 357€) = 434 € per saved m<sup>3</sup> oil.
- Replacing 100 m<sup>3</sup> oil with pellets gives an average saving of approx. 43,352 €/year.
- Heating with pellets is 55% cheaper than oil and you reduce carbon dioxide emissions by 277 tons for every 100 m<sup>3</sup> heating oil saved.
- The changeover from oil to pellets will pay for itself after 3-5 years, depending on the size of the plant.

(Prices based on February 2008 figures and excl. VAT in Sweden)

Lastly, using a fuel pellets plant is safe, convenient, reliable and environmentally beneficial, that will to a large extent, influence our own and our children's future.

## If you need help with a project

It is very important when planning a fuel pellets plant that the right prerequisites are in place to ensure a successful project.

Both we and our retailers gladly share our extensive experience to help customers on how best to invest in heating with fuel pellets.

Contact us or one of our retailers if you would like to discuss a fabrication or plant, and together we'll find a solution for each specific project.



*MAFA's Head Office and modern production facilities are located in Ängelholm, North West Skåne.*

### **The success started in 1958....**

when MAFA's founder Gusten Andersson had a brilliant idea for the management of bulk materials. During the last 50 years, MAFA in Ängelholm has grown into a company with a wealth of experience and tradition in the design and production of equipment for the handling and storage of bulk materials in silos.

MAFA utilizes the latest techniques and has a competent workforce capable of producing everything from a conventional silo, to a tailor-made, efficient, and specialized plant for bio-energy, industry or agriculture.

Today, MAFA is the market leader in Sweden and more than 50% of our production is for export.



*More info on MAFA and MAFA's System Solutions for the handling of pellets can be found on our web site [www.mafa.se](http://www.mafa.se), where the latest product leaflets and printed literature can be downloaded.*

*Retailer:*

**Satisfied customers are the best we know!**



[www.mafa.se](http://www.mafa.se)