



The new DUB 3 Grate

**60 % reduction in
required time for
maintenance**



**80% less riddling.
Minimal aluminum
fall through the
grate**



Facts about Dublix Technology

- Specialized in plant optimization providing 3-10 % more efficiency/plant capacity
- Combustion engineering, CFD calculation and plant capacity calculations
- Grate part for major waste combustion plants in Scandinavia and abroad
- Operator support systems based on the FuzEvent combustion control system
- Employees with experience from the WtE for more than 20 years
- Boiler pass (radiation passes) cleaning with the DD-Jet water jet systems



Photo 1 from the installation of DUB 3 grate in Tees Valley, UK, 2011



Document History

11.6.2013, issue with rail mounting pictures and text.
01.8.2013, issue with 7 reasons for the new DUB 3 design.
12.5.2015, updated with new reference in Italy

Document liability

We accept no liability for typographical, spelling and drafting errors. Performance data stated are provisional and subject to revision.

Filing

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Photo 2 Details from an early grate carpet installation in Denmark

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Executive summary

From all plants where the DUB 3 grate have been installed, we have received positive information that the DUB 3 grate design has optimized the combustion efficiency and operating with less excess air and lowering the emission levels particularly the NO_x emission value.

This document describes the strong unique features built into the new Dublix designed Grate, DUB 3. The DUB 3 grate can directly substitute the grate carpet for plants based on the classical Vølund combustion system.

The DUB 3 system is perfect for implementing complete new combustion systems with grate box, combustion air system and slag extraction system etc.

The background for initiating the DUB 3 grate design is a wish to extend the lifetime of existing combustion systems of which many have been in operation for more than 20 years. The new design includes features achieving the same performance as seen on “*state of the art*” combustion systems.

The DUB 3 grate carpet has been designed in such a way that it does not require modification of the existing combustion system. It is possible to reuse the design of primary and secondary air system as well as the waste feeding and slag extraction systems.

The DUB 3 grate carpet described in this document shows unique high precision grate equipment, based on a modern manufacturing technique with features for using a multitude of alloys performing to different quality demands. This provides a very high performance and control of the primary air distribution.

The development of the DUB 3 grate has been made in close cooperation with our existing clients already operating the classical design for many years and knowing the advantages and disadvantages of the original design. The philosophy of Dublix has always been to maintain a continuous close dialogue with the plant operation expertise.

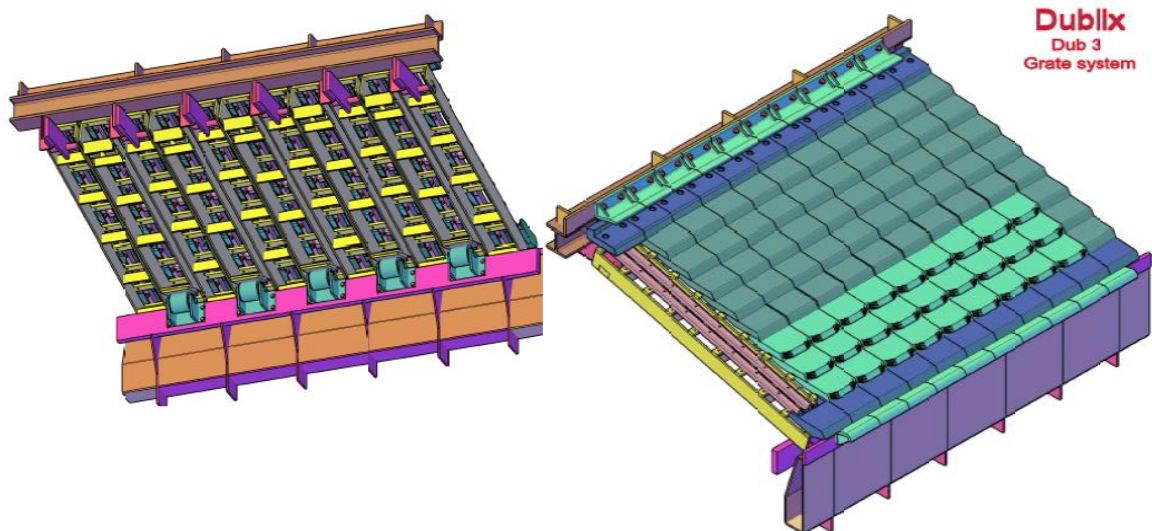
The new DUB 3 grate has now been delivered to more than 20 combustion lines (August 2013) in different countries in Europe.



Photo 3 The I/S REFA plant in the south of Denmark with 3 combustion lines was one of the first installations in Denmark with Type DUB 3 grate

The 7 important reasons for selecting the DUB 3 grate system.

1. DUB 3 grate combustion system is a unique and trouble-free construction, with numerous of efficiently operating similar references during many years.
2. DUB 3 grate combustion system is based on a proven grate system, recently reengineered and up to date providing state of the art solution characterized by; high grate pressure drop and very low riddling throughout the complete operational period.
3. DUB 3 grate combustion system provides low CO and low NOx levels and operates with low excess air providing high boiler efficiency.
4. DUB 3 grate combustion system provides unique features such as; optimized lateral grate carpet adjustment system and long lasting support rollers for drive mechanism.
5. DUB 3 grate combustion system provides high availability with operational periods, normally > 3 years without need for major grate carpet part exchange.
6. DUB 3 grate carpet is easy to install and repair; the exchange of the grate carpet is done from the grate top side, each single grate component weight is less than 20 kg avoiding heavy load on workers and reducing the required maintenance period.
7. DUB 3 grate carpet can be selected for large variation of fuel categories, range of heat values and ash types. It can be configured for specific client requirements, such as air penetration levels through the different grate carpet sections as well as special alloy quality.



Bottom and top view of the DUB 3 Grate



Transformation into DUB 3 and the DUB 3 Features

- The grate carpet plates are available in different models in order to choose the correct air penetration.
- The grate carpet plates can be selected in different alloy qualities in order to accommodate the thermal load required in the different regions of the grate carpet.
- The applied casting technique is based on the high precision lost wax method providing means to design very complex plates.

The figures below and on the following pages illustrate the stages of transformation from a traditional Vølund grate carpet into a DUB 3 carpet demonstrating all the plate models.

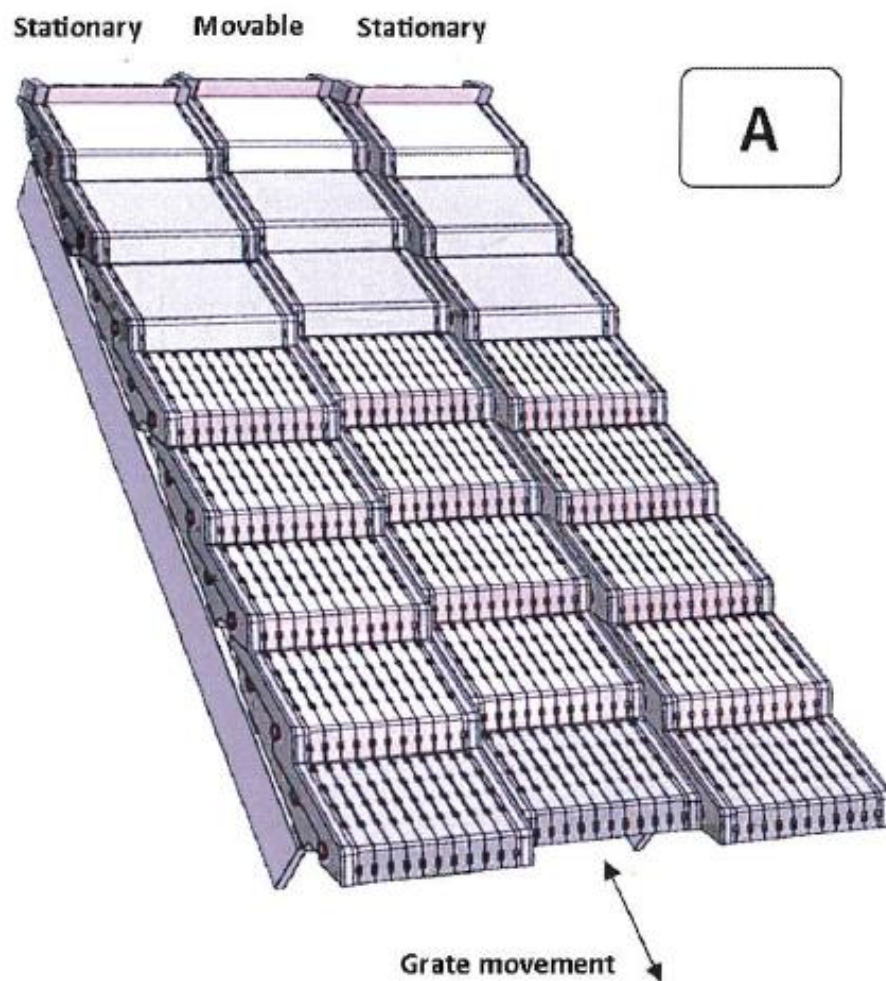


Figure 1 original Volund grate

The waste transport function of this grate is unique compared to other grate carpet designs. The system is based on a stationary grate part and a movable grate part. The mechanical wear is between the stationary and movable sections. The grate system has a flexible and very reliable structure. With the new features build into the DUB 3 grate this system achieves heavily improved performance.

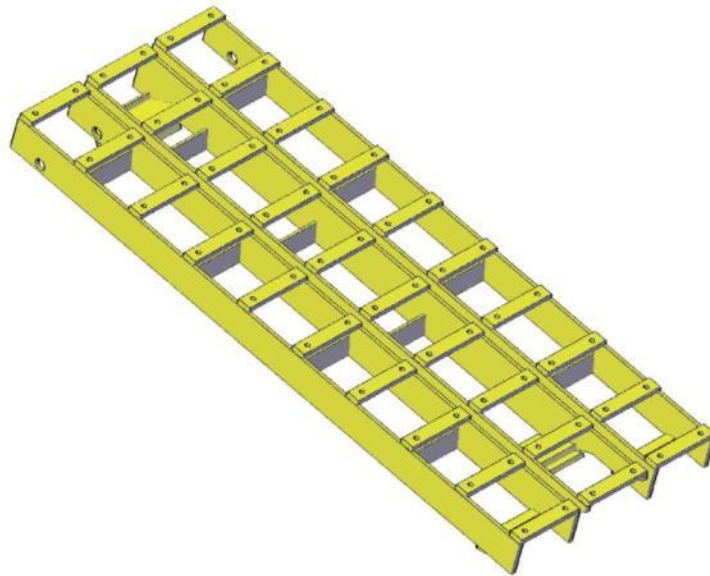


Figure 2
Original girders stripped for grate carpet components

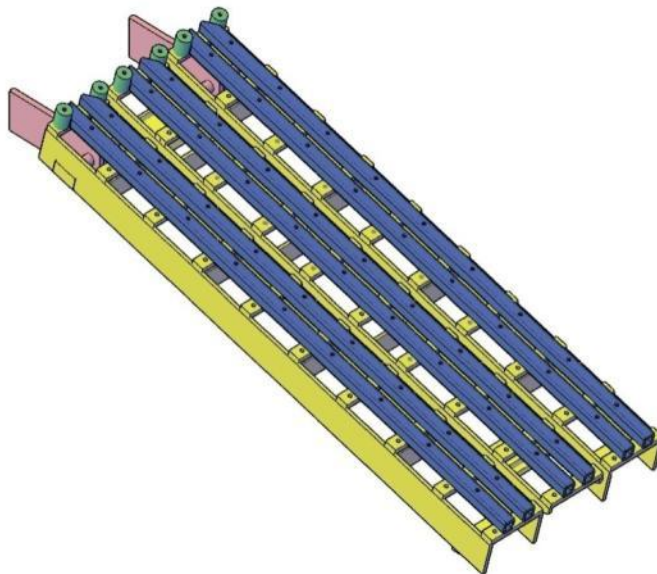


Figure 3
Original girders now fitted with rails for mounting of all plates except seal plates especially for mounting of seal plates
These rails and long nuts are permanent fittings because they are sheltered against both mechanical and thermal wear. They are, however, easy to replace in case they have been damaged.

The girders shown here are state of the art Dublix design. They are easier and faster to handle during replacement and maintenance works.

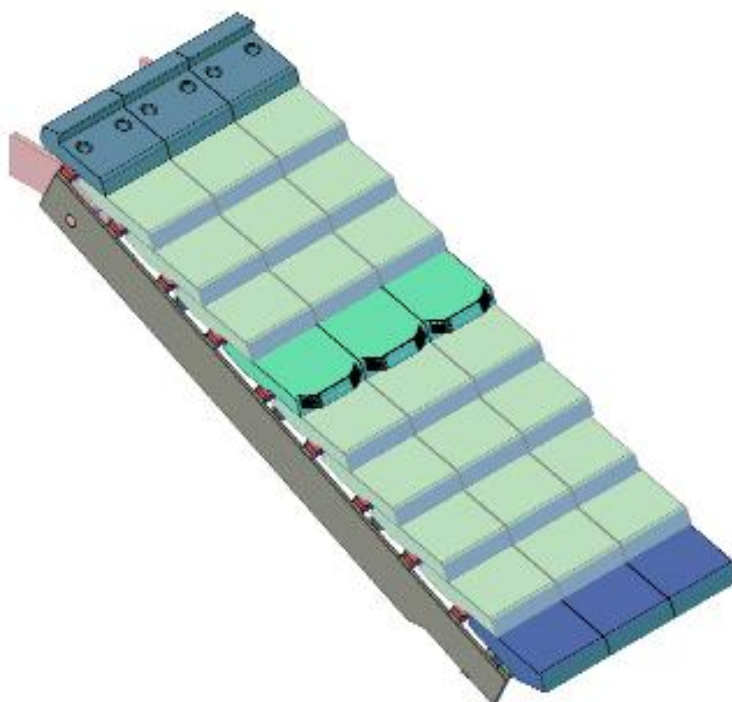


Figure 4

Grate carpet DUB 3 mounted on the original girders or new improved Dublix design girders 100 % compatible with the original design. Only the visible plates are subject to mechanical and thermal wear. Only those plates will eventually need replacement.

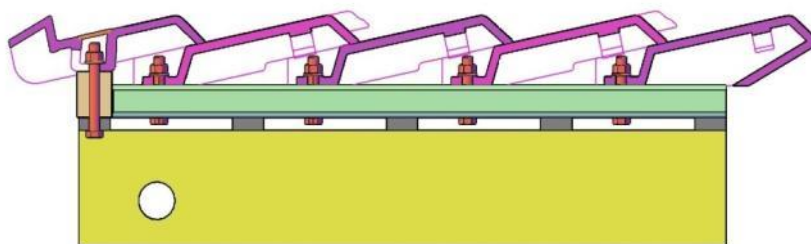


Figure 5

Longitudinal section in a stationary girder totally fitted with DUB 3 carpet components. This girder is drawn for illustration only. No real girder is so short.

The fitting sequence is easy:

You bolt the Lower Plate onto the rails using the lowest set of bolt through holes in the rails 170 mm from the low end of the girder. The next plate may be the Nose Plate shown or a Closed Plate according to the grate carpet lay-out. The last plate to the far left is the Seal Plate. Here 2 pre-erected bolts will appear in its 2 fastening wells. You slide a snug washer over the bolt and follow with a nut. Finally you close the wells with covers which you secure with tack welds. Easy to open with a chisel and a hammer once you need to replace that plate or all plates on the girder.

Removal of grate plates begins with the Seal Plate and ends with the Lower Plate. Like roof tiles the individual plate conceals the fitting bolts of the lower situated plate. (except the Lower Plate)

Various designs of the DUB 3 Grate plate



Figure 6

Mounting Rails. The chamfered ends shall be situated at the upper end of the grate girder and the lowest set of bolt through holes 170 mm from the girder low end.



Figure 7

Long Nut. Shall be situated at the chamfered end of each mounting rail, where it is fitted with a long bolt to the top rung of the girder. It will support the Seal Plate.

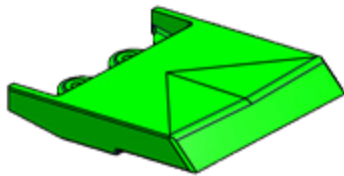


Figure 8 Closed Plate.

For use along walls and across the first and last grates

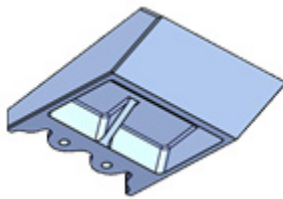


Figure 9

Lower Plate for use only at the low end of the grate

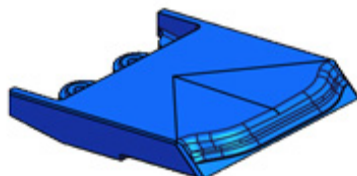


Figure 10

Nose Plate for use everywhere except sides, high and low ends

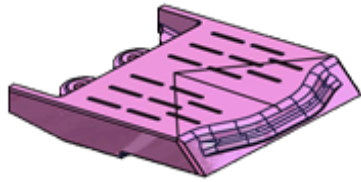


Figure 11

Nose Plate for use everywhere except sides, high and low ends

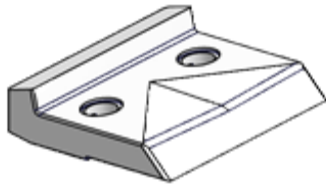


Figure 12

Seal Plate for use only at the high end of the grate

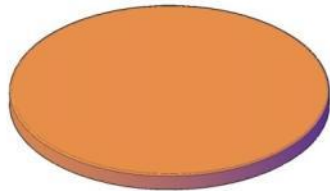


Figure 13 Well Cover

Cover for the fastening wells in the seal plate



Photo 4 careful inspection of the details in the DUB 3 grate carpet



Photo 5 other clients are carefully following an inspection at I/S REFA

Installation and maintenance of the new DUB 3 Grate

- DUB 3 grate carpet can be installed fast on the same structure as the original grate carpet.
- Maintenance and replacement of single DUB 3 grate plates can be done from the top of the grate. The maintenance time can be reduced to 30 % of the time normally required for the original classical design.
- An existing combustion line with more grate sections can be operated with a mix of DUB 3 grate carpet plates for the most stressed parts and the existing classical design can be kept for other parts.
- Normally no needs for adjustments in the operation and control of the combustion process as the DUB 3 grate carpet fitting can be designed close to the process design for the existing grate.

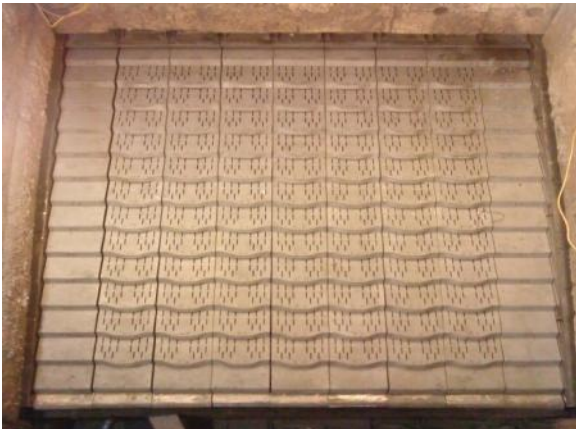


Photo 5, The new Type DUB 3 grate carpet installed inside an existing old classical Vølund combustion system.



Photo 6 details from an installation in France





Photo 7 details from an installation showing the earlier hook fastening system, protected from the heat exposure under the grate surface

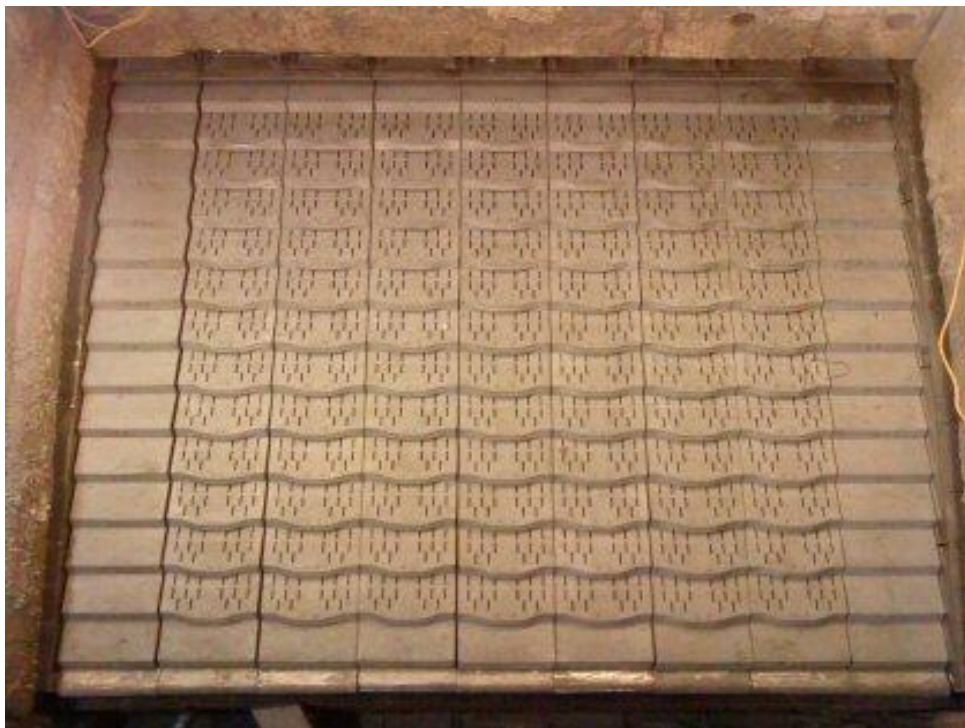


Photo 8 Type DUB 3 Grate, a homogeneous air penetration grate surface selected.



Photo 9 the well proven spring loaded Dublix lateral adjustment system is normally applied to the DUB 3 grate carpet



Photo 10 Careful quality checks are always applied



Photo 11 lost wax production site



Photo 12 Tees Valley (UK) during erecting



Photo 13 Tees Valley (UK), almost finished grates 2.5.2011



Experience from plants with DUB 3 Grate

Experience from Danish installations shows major reduction in riddling down to 10 % of level normally seen.

Original design remains unchanged for the primary air and secondary air injection as the new grate carpet can be designed to the same air penetration as the original grate carpet.

A continuous stability in the air distribution has been observed with reliable grate lateral adjustment system.

Long term stability with very low grate carpet wear and providing < 10% wear over 2-3 years of operation.



Photo 14 inspection after 4 month's operation shows a tight carpet surface



Reference plants in Scandinavia with DUB 3 Grate



Photo 15 I/S REFA, August 2010



Photo 16 Nordforbrænding, Hoersholm, June 2010



Photo17 DONG Energy Horsens kraftvarmeværk, Horsens



Photo 18 installation at DONG Energy Horsens kraftvarmeværk



International references



Photo 19 SITA Tees Valley (UK) Installation on 2 lines, May & September 2011



Photo 20 AISA, Arezzo (IT) DUB 3 Installation on 1 line, September 2013-2017

DUB 3 Parts List.

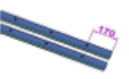
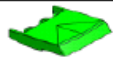






	Illustration	Nominal width code	Designation code	Variation no.	Material code	Nominal/actual width [mm]	Material designation or product code	Full designation of item (functional description) Employ of item	Aprox. Weight Kg
1		50	MR	0	35	50	S235 JR	<u>Mounting Rail</u> Two rails per grate girder as foundation for mounting the plates. The rail length is 200 mm shorter than the nominal grate length. Thus 2300 mm for a 2.5 m long grate. The first mounting hole shall be 170 mm up from the lower end of the grate girder.	8/m
3		300	CP	0	23	300/296	DIN 1.4823	<u>Closed Plate</u> For use along walls and on first and last grates	15
4		300	LP	0	23	300/296	DIN 1.4823	<u>Lower Plate</u> For use only at the low end of the grate	15
5		300	NP	0	23	300/296	DIN 1.4823	<u>Nose Plate</u> (primary air is introduced through the nose) For use everywhere except sides, high and low ends	14
6		300	NP	1	23	300/296	DIN 1.4823	<u>Nose Plate</u> (primary air is introduced through the nose and top) For use everywhere except sides, high and low ends	15
7		300	SP	0	23	300/296	DIN 1.4823	<u>Seal Plate</u> For use only at the high end of the grate	14
8		ø55	WC	0	35	ø55	DIN 1.4835	<u>Well Cover</u> Cover for the fastening wells of the lip seal plate	0.1
9		M16	LN	0	35	M16	S235 JR	<u>Long Nut</u> (distance piece under lip seal plate fastening wells) Support under fastening wells	0.8

Figure 14 Grate parts

Appertaining parts between grate carpet sections





	Illustration	Nominal width code	Designation code	Variation no.	Material code	Nominal/actual width [mm]	Material designation	Full designation of item (functional description) Employ of item	Aprox. Weight Kg
10		300	UT	0	23	300/296	DIN 1.4823	<u>Upper Transition plate</u> Top protection of refractory transition wall	19
11		300	LT	0	23	300/296	DIN 1.4823	<u>Lower Transition plate</u> Support of refractory transition wall	19
12		300	FS	0	23	300/296	DIN 1.4823	<u>Fifteen to Seven and a half degree transition plate</u> Separation between 15 °and 7.5° grate boxes	28
13		300	FF	0	23	300/296	DIN 1.4823	<u>Fifteen to Fifteen transition plate</u> Separation between X° and X° grate boxes	29

Figure 15 Grate parts

Typical DUB 3 combustion system layout

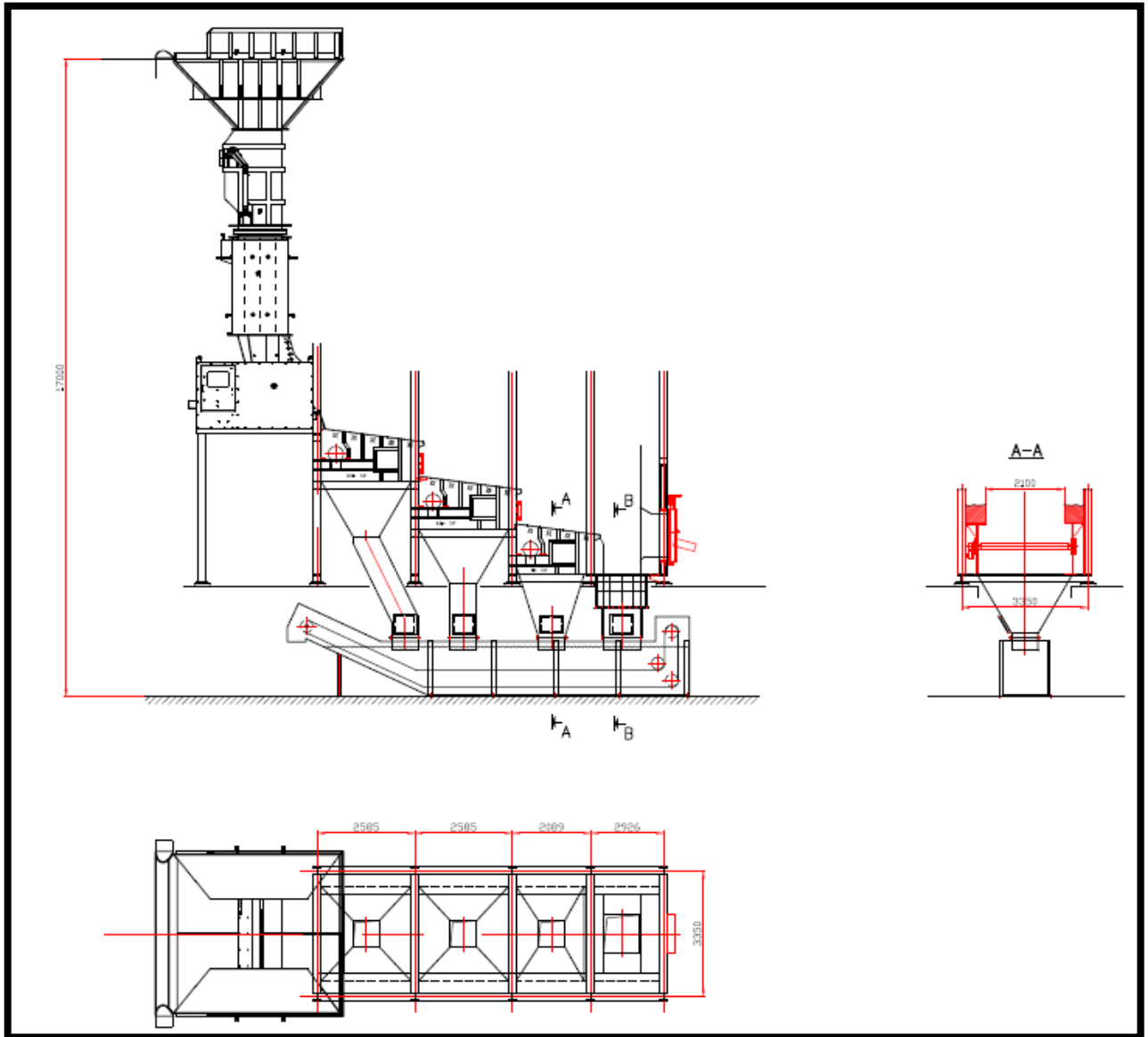


Figure 16 DUB 3 Combustion System layout.

The DUB 3 Combustion System is based on a well proven design operating on many WtE plants for many years.
The classical design can easily be adjusted to operate different plant capacity and waste heating values.