

Laminar Air Flow Unit



ELEKTROTEKNIK

Laminar Air Flow Unit

Clean room is a closed space which contains under controlled amount of microorganisms, temperature, humidity, fresh air flow rate, ambience pressure, air stream directions and similar parameters. Operating rooms, intensive care units, sterilization units, IVF units, genetic laboratories, medical laboratories and etc, are classified as clean rooms.



If we take a look to sectors for used laminar air flow unit usage; specially operating rooms, medicine industry, chemical industry, food industry, electronic industry and research laboratories are become slightly more important applications than others.



Clean rooms have laminar air stream and the air stream is parallel to each other. Air velocity is a constant in every points of air stream (above the table air velocity is 0,22 m/s-0,28 m/s). In turbulanced air stream, air stream is random (0,35 m/s-0,55 m/s).

Turbulanced Flow



Laminar Flow

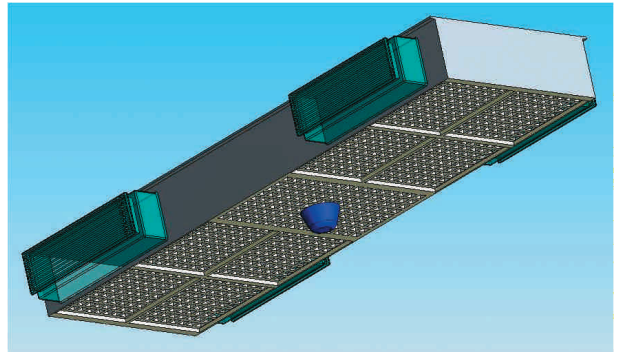


According to researches in a rooms which have a turbulanced and laminar air stream and they have same dirty ratio.. In every same conditions exempt air stream, if we put a vessel under air stream. The result; under laminar air stream, amount of microorganism is 0, under turbulanced air stream, amount of microorganisms are 200. From this result, for hygienic applications laminar air stream must be provided.

Laminar Air Flow Unit



Supply air for the operating room must be provided from hygienic air handling units and according to DIN 24185 standard, air must be filtered by B2 and C classes filtering. The air which prepared this way, blown to the operating room by passing through high performed filters. Supply air temperature must be 1-3°C lower than the operating room temperature.



The importance of laminar air flow unit is; if the quality of air is not between the specified levels, blown air increases the risk of patient may get infected during operation. Laminar air flow units are designed and manufactured to solve this problem. These units supply laminar air stream from ceiling to floor. By this way patient will be protected from viruses, bacterias and microorganisms.



Advanced Medical Concepts



Air Ceiling



Light Ceiling

Filter Position Options



Filters on side air inlets



Filters over the surface

High-quality Materials

HOUSING OPTIONS

- 1- 2,0 mm Sheet steel antistatic powder coated in white 9016
- 2- 3,0 mm Aluminium sheet antistatic powder coated in white 9016
- 3- 2,0 mm Stainless Steel AISI 304 // 316

EASY to CLEAN DIFFUSER

- 1- High Performance Fabric Laminariser
- 2- Stainless Steel AISI 304 // 316

Note : Depending on the requirements, Elektrotechnik supplies differential laminarisers allowing a higher speed in a defined area of the exhaust field to counter, for example, the negative influence of surgical lights on the airstream.

OPTIMISED SURGICAL LIGHTS LEADTHROUGH

Elektrotechnik Laminar Flow units include a leadthrough for the surgical lights support providing easy access to the ceiling flange at all times. The air distributors (fabric or mini-perforated plates) have a minimal blind area.

FILTERS

The horizontal position of the H14 filter across the entire outlet surface or inlet of the laminar flow units allows carrying out a precise leak test. Since ELEKTROTEKNIK uses standard filter sizes, all commercially available brands, or optionally H 13 filters, can be fitted.

PERIPHERAL LIGHTING

For peripheral lighting, direct luminaires for clean rooms are equipped with electronic multi-watt ballast units, which are wired ready-to-connect with heat-resistant cables and designed for mains operation at 230 V 50 Hz. In addition, these luminaires have permanently installed connection terminals for electrical connection with a conductor cross-section of up to 2.5 mm².

PRIMING ILLUMINATION

The priming illumination is installed in the air distribution box at the same height between the HEPA filters above the transparent distributor. Design as 3-sided LED continuous line luminaire with optimised lens cover and integrated electronically dimmable operating devices (or 0–10 V), matched to the operating table control.

FLOW STABILISERS

Flow stabilisers are used to reduce the constriction of the low -turbulence displacement flow, mainly with rectangular and square ceilings, or with ceilings with integrated recirculation modules.

This prevents the air from short circuiting away from the adjacent exhausts and stabilises the air flow directly after the flow laminariser to the outside. Return flows of contaminated room air are also prevented and the planned protection zone is ensured. The laminated safety glass panes a minimum thickness of 8 mm are held by an aluminium or SS frame.

ADDITIONAL FRAME SYSTEM

In order to be able to integrate the peripheral lighting as well as the ceiling pendants, an additional frame of extruded aluminium profiles is used.

Necessary facings between the luminaires and their fixing brackets are prefabricated in powder-coated aluminium according to the manufacturer and type of luminaire.



- Cleanroom class acc. to DIN EN ISO14644-1

- Pressure drop measurements

- Microbiological germ determinations in the air and on surfaces

- Leak test using test aerosol (DEHS test) acc. to EN ISO 14644-3

- Acceptance measurements of LF systems in accordance with all valid standards

- Turbulence degree measurement according to DIN 1946- 4,

Laminar air flow units are mounted above of the operation table. Unit does not required another inner cap because, it's desing provides controlled and sterilized air stream. Initial investment cost of this product is lower than the others. Microbes and other particles which are sucked by exhaust grilles, are pushed down by vertical laminar flow. By the help of positive pressure which is created in the operating rooms, protects the operating room from dirty outer air.

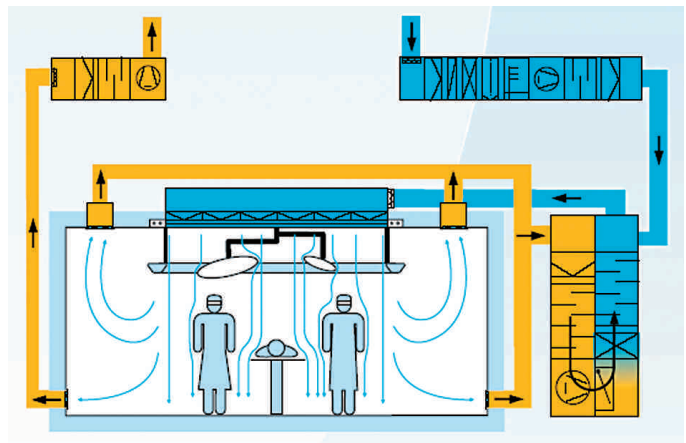
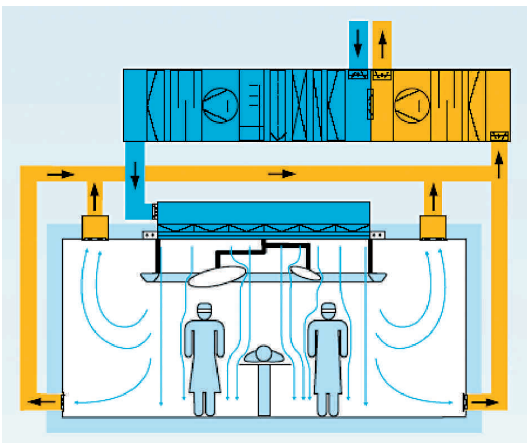
In applications, the most important factor, which effects laminar air stream, is pendant lamp. This happens, because of the thermal convection. So, the size and the placement of the lamp have importance. The most suitable application is, system has multiple spotlight which have smaller size and must be placed behind the operating equipment.



While system is working, the permeability of the filter is decreased but, pressure difference is increased. The permeability is calculated by differential manometer.

For this purpose, two pipes are mounted to inlet and outlet of the laminar flow unit. When the pressure difference reaches double of the starting level, the filter needs to be changed.

Applicable System Examples



EN 1822 – The test method for particulate air filters

Classification Standard EN1822

Efficient air filters (EPA), high efficiency air filters (HEPA) and ultra low penetration air filters (ULPA-filters) which used in the field of ventilation and air conditioning and for technical processes, e.g. for applications in clean room technology or pharmaceutical industry are classified and tested according to the EN 1822:2009 standard.

EN1822 Classification

Filter Group	Class	MPPS Integral Values		MPPS Local Values		Minimum Efficiency (%) @ DOP (0,3 µm)
		Efficiency (%)	Penetration (%)	Efficiency (%)	Penetration (%)	
EPA	E10	85	15	-	-	95
	E11	95	5	-	-	99,9
	E12	99,5	0,5	-	-	99,97
HEPA	H13	99,95	0,05	99,75	0,25	99,99
	H14	99,995	0,005	99,975	0,025	99,999
ULPA	U15	99,9995	0,0005	99,9975	0,0025	-
	U16	99,99995	0,00005	99,99975	0,00025	-
	U17	99,999995	0,000005	99,9999	0,0001	-

MPPS: Most Penetrating Particle Size

Classification Standard EN ISO 14644-1

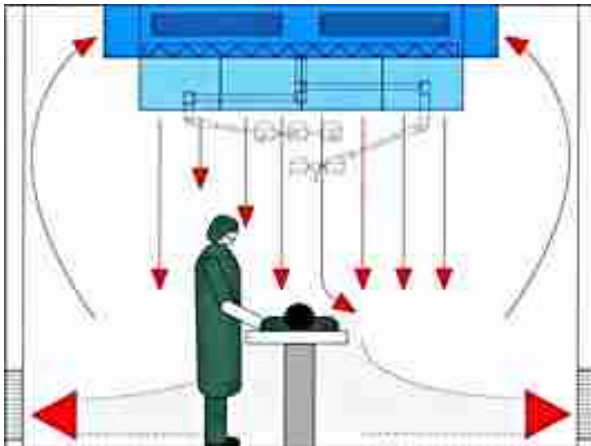
ISO 14644 defines the classification of air cleanliness in cleanrooms and associated controlled environments exclusively in terms of concentration of airborne particles. Only particle populations having cumulative distributions based on threshold (lower limit) particle sizes ranging from 0.1 µm to 5 µm are considered for classification purposes.

Cleanroom Classification

ISO 14644 (@0,5µm)	Maximum concentration limits for particles equal to and larger than the considered size shown below (particles/m³)						Fed Std. 209 E (class)
	0,1 µm	0,2 µm	0,3 µm	0,5 µm	1,0 µm	5,0 µm	
ISO Class 1	10	2					-
ISO Class 2	100	24	10	4			-
ISO Class 3	1.000	237	102	35	8		1
ISO Class 4	10.000	2.370	1.020	352	83		10
ISO Class 5	100.000	23.700	10.200	3.520	832	29	100
ISO Class 6	1.000.000	237.000	102.000	35.200	8.320	293	1000
ISO Class 7				352.000	83.200	2.930	10000
ISO Class 8				3.520.000	832.000	29.300	100000



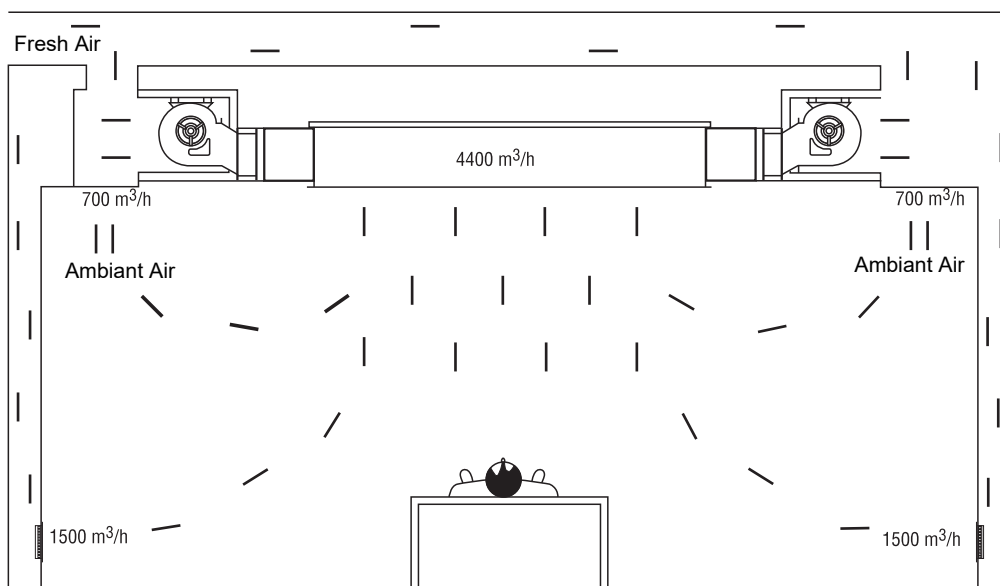
HEPA filter panel during the scan test



Recirculating Systems

The difference between recirculating systems and 100% fresh air systems is; in recirculating systems part of the exhaust air filtered by laminar flow unit and used with supply air. by this way supply air mixed with a part of exhaust air. To make it, radial fans must support the system before laminar flow inlets. velocity of radial fans are adjustable and lower sound level is suggested.

Part of the sucked air is exhausted and rest of air used in recirculating system. So that, fibre holder grille must be used in front of the sucking neck of the the laminar flow.



Recirculating Systems Product Benefits

PRODUCT BENEFITS

- Lowest germ counts <10 cfu/m³ acc. to valid standards
- Ensures rapid removal of airborne contaminants (particles and germs) from the surgical zone
- Very low sound pressure level ≤ 48 dBA Minimised pressure drops and low energy consumption through the use of HEPA filters from our in-house production
- Fulfils all acceptance tests; leak test with test aerosol (DEHS test), protection zone determination (at rest), determination of the degree of protection, determination of the degree of turbulence

FUNCTIONAL PRINCIPLE

Only a small part of the preconditioned supply air is passed into the pressure chamber of the LF ceiling via a central air handling unit, mixed with a larger part of the circulating air, which is conveyed through ceiling recirculation modules and guided over an in-built HEPA filter.

The supply air is filtered and blown out at a speed of 0.25 (0.38) m/s in the direction of the surgical protection zone via a flow optimised, trapezoid profile covered with a double-layered special diffuser. The surgical zone includes both the surgical team and the patient as well as the instrument and side tables.

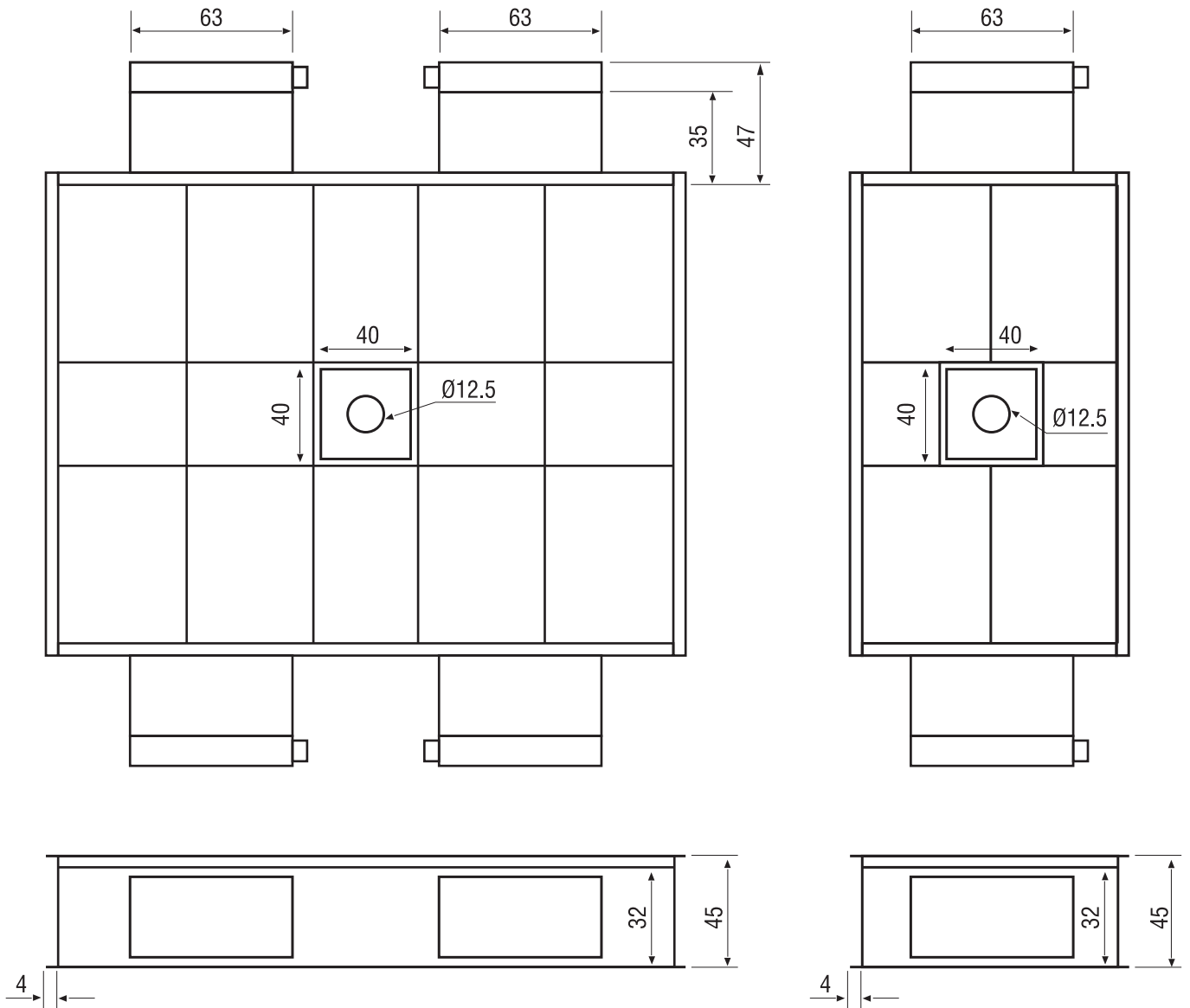
Contaminants in the working/patient area are detected by the low-turbulence displacement flow and discharged via fluff separators near the floor and via exhaust of the recirculation modules close to the ceiling.

Circumferentially-fitted flow stabilizers prevent lateral inductions. As a result, the integration of the recirculation LF ceiling into a media bridge system is also possible.

PRODUCT CHARACTERISTICS

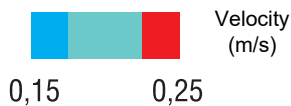
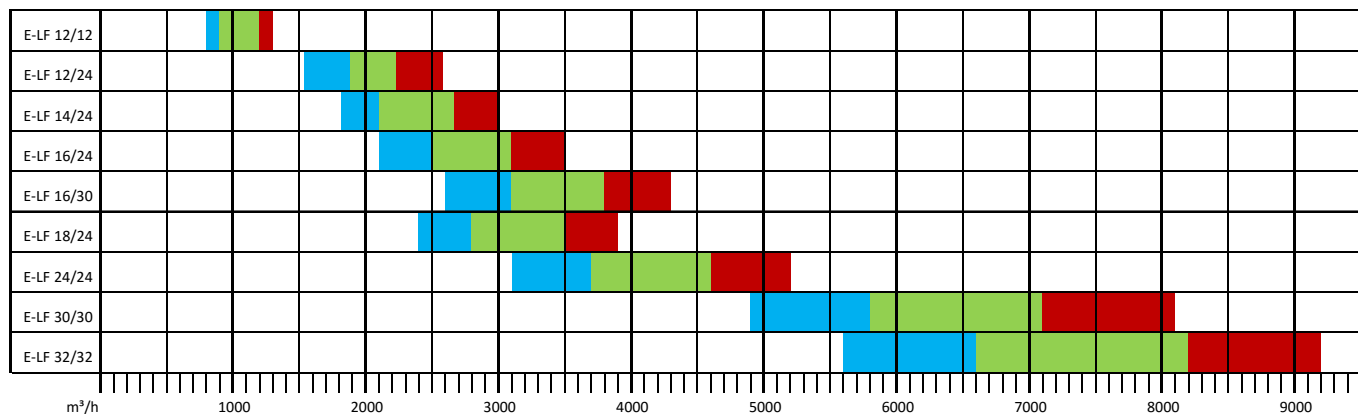
- | | |
|--|--|
| - Pre-filter ISO ePM1 $\geq 50\%$ acc. to DIN EN 16890-1; minimised pressure drop through our in-house produced fine dust filters | - Pressure side, self-closing backflow preventer |
| - EC fans with low energy consumption and constant volume flow control integrated in the module | - Depending on the ceiling size different numbers of modules can be combined |
| - Reduction of the central AHU and the total cost of installation | - Optional installation of coolers for dry cooling |
| - Low sound pressure level of ≤ 48 dBA due to self-developed sound attenuator and sound insulation/test in own sound laboratory | |

Technical Datas



MODEL	SIZE (mm * mm)	HEIGHT mm	MIN CEILING HOLE	FLOW RATE	FACE VELOCITY	HEPA FILTER DIMENSION	HEPA FILTER QUANTITY	PRESSURE LOSS START - FINAL
E-LF 12/12	1200 * 1200	450	450	780 - 1300 m ³ /h	0,15 - 0,25 m/s	305*610*292	2	300 - 500 Pa
E-LF 12/24	1200 * 2400	450	450	1555 - 2600 m ³ /h	0,15 - 0,25 m/s	305*610*292	2	300 - 500 Pa
E-LF 14/24	1400 * 2400	450	450	1815 - 3020 m ³ /h	0,15 - 0,25 m/s	305*610*292	2	300 - 500 Pa
E-LF 16/24	1600 * 2400	450	450	2080 - 3460 m ³ /h	0,15 - 0,25 m/s	305*610*292	4	300 - 500 Pa
E-LF 16/30	1600 * 3000	450	450	2600 - 4350 m ³ /h	0,15 - 0,25 m/s	305*610*292	4	300 - 500 Pa
E-LF 18/24	1800 * 2400	450	450	2350 - 3890 m ³ /h	0,15 - 0,25 m/s	305*610*292	4	300 - 500 Pa
E-LF 24/24	2400 * 2400	450	450	3110 - 5190 m ³ /h	0,15 - 0,25 m/s	305*610*292	4	300 - 500 Pa
E-LF 30/30	3000 * 3000	450	450	4860 - 8100 m ³ /h	0,15 - 0,25 m/s	305*610*292	6	300 - 500 Pa
E-LF 32/32	3200 * 3200	450	450	5530 - 9210 m ³ /h	0,15 - 0,25 m/s	305*610*292	6	300 - 500 Pa

Selection Table



Flow Rate
(m³/h)

Selection Sugestions

When general classification has made;

High sterilized rated rooms (Class 100 or lower):

Operation rooms, intensive care rooms, skin burn treatment rooms, sterilized material storages.

Normal sterilized rated rooms (Class 10.000):

Patient, radiotherapy, medical dressing, physical therapy, endoscopy applications and delivery rooms.

CLASS	Particle Quantity /m³				
	0,1 µm	0,2 µm	0,3 µm	0,5 µm	5 µm
1	1.240	265	106	35	-
10	12.400	2.650	1.060	353	-
100	-	26.500	10.600	3.530	-
1000	-	-	-	35.300	247
10000	-	-	-	353.000	2.470
100000	-	-	-	3.530.000	24.700

In operation room applications, laminar flow units are selected in accordance with required air quality and air flow rate. When selecting the unit, outlet velocity must be between 0,15 m/s and 0,25 m/s.

İstanbul Fabrika



Eskişehir Fabrika



ELEKTROTEKNİK
Klima Sanayi ve Ticaret A.Ş.



Fabrika / Factory-İstanbul
Atatürk Cad. Çağatay Sok. No:3 Sarıgazi
Sancaktepe 34785 İstanbul/TURKEY
Tel / Phone :+90 216 499 14 64 (pbx)
Faks / Fax :+90 216 499 66 19



Fabrika / Factory-Eskişehir
Eskişehir OSB Şehitler Bulvarı No:29/A
23110 Eskişehir/TURKEY
Tel / Phone :+90 222 236 20 40
Faks / Fax :+90 222 236 20 49



Fabrika / Factory-Eskişehir
Eskişehir OSB Şehitler Bulvarı No:29/B
23110 Eskişehir/TURKEY
Tel / Phone :+90 222 236 20 40
Faks / Fax :+90 222 236 20 49



Fabrika / Factory-Eskişehir
Eskişehir OSB 21.Cad. No:15
23110 Eskişehir/TURKEY
Tel / Phone :+90 222 236 20 40
Faks / Fax :+90 222 236 20 49