
# DRAINAGE SYSTEM


TÜV SÜD ISO 9001 TÜV SÜD ISO 14001

## TECHNICAL CATALOGUE

europlast

europlast

Among the more and highly qualified manufacturing plants which characterize North-East Italy, Europlast is one of the most outstanding examples of success and quality. Established in 1968, since 1991 it has been part of the Aliaxis Group.

Europlast specializes in the production of accessories for surface drainage, fittings and ventilation grills. It owes its growing success to the professional quality and technology of its molding systems using injected PVC, PP and ABS.

The molding systems, entirely controlled by special machines equipped with appropriate softwares, make it possible to turn out high quality products and to guarantee a high level of durability of the mentioned items. The design department is constantly in search of new solutions and new products capable of meeting the challenges of the market, and it performs continuous testing of the quality of its supports.

Europlast is certified UNI EN ISO 9001 and UNI EN ISO 14001 by the certification institute TÜV.

The profession personnel of its sales network are able to provide the customer with advice in a consultant role in which they suggest the right product for every case, and the best solution for every type of building problems. Thanks to the strength of the sales network, the company has increased its exports sales, with successful penetration of Europlast products in Europe, America, Africa, Russia and the Far East.
The company's service mentality completes a picture that, with its vocation for research, finds its fullest expressed in customer satisfaction. Our clients know that, today, Europlast is the best in terms of quality and service.


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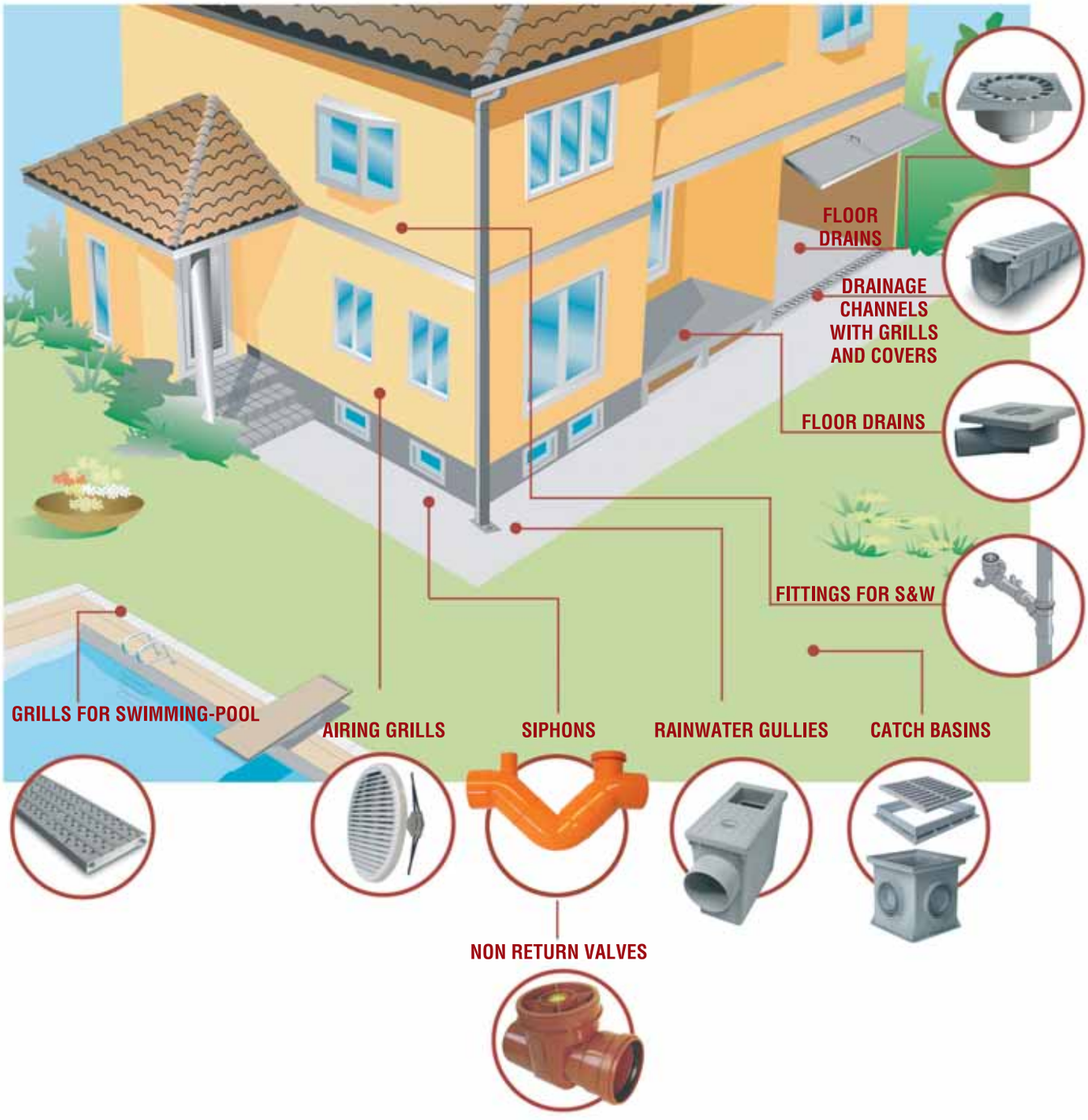
# company profile



EUROPLAST

# Plastics for building... a complete range!





Quality management
ISO 9001


Compliance with regulation
EN 1329


Environmental
management ISO 14001

## CHEMICAL RESISTANCE OF RAW MATERIALS

EUROPLAST floor drainage system products are made by moulding the following plastics:

• Polyvinyl chloride (PVC), thermoplastic polymer obtained from polymerization of vynil chloride. PVC is nowadays more and more largely used in buildings, thanks to its resistance to external atmospheric agents and to mechanical solicitations.
• Polypropylene (PP), thermoplastic polymer obtained from polymerization of propylene. PP, thanks to its versatility, is largely used in buildings, mainly when product doesn't require specific resistance performances.
• Acrylonitrile – Butadiene – Stirene (ABS), thermoplastic copolymer obtained from polymerization of Acrylonitrile, Butadiene and Stirene. ABS, because of its characteristicsis particularly used for shock resistant items which satisfy aesthetical requirements.

Raw materials used to realize DRAINAGE SYSTEM products are subjected to periodical controls in EUROPLAST chemistry laboratories. Their formulation has been carefully studied to optimize their chemical and mechanical resistances.
The following tables are the result of several laboratory tests. It is important to check the real behaviour during practical use. EUROPLAST Technical Department can support its customers with its over 40 years long experience in moulding PVC, PP and ABS.

## TECHNICAL CHARACTERISTICS - PVC

### PVC MECHANICAL FEATURES (23°C)

| CHARACTERISTICS | TEST | SIZE | RESULT* |
|---|---|---|---|
| Yeld point | ISO 527 | $Kg/cm^2$ | 530 |
| Breaking load | ISO 527 | $Kg/cm^2$ | 430 |
| Enlongation at break | ISO 527 | % | 70/80 |
| Traction stretch | ISO 527 | $Kg/cm^2$ | 34.000 |

### PVC PHYSICAL FEATURES

| CHARACTERISTICS | TEST | SIZE | RESULT* |
|---|---|---|---|
| Mass volume | ISO 1183 | $Kg/dm^3$ | 1,43 |
| Vicat softening temperature | ISO 306-B | °C | 80 |
| Thermal linear expansion coefficient | / | mm/m°C | 0,07 |

* = Data obtained from tests effected: • Test tube type ISO 2
• Traction speed = 5 mm/min
** = Temperature: • min. - 10° • max. 60°

## TECHNICAL CHARACTERISTICS - PP

### PP MECHANICAL FEATURES (23°C)

| CHARACTERISTICS | TEST | SIZE | RESULT* |
|---|---|---|---|
| Yeld point | ISO 527 | $Kg/cm^2$ | 260 |
| Breaking load | ISO 527 | $Kg/cm^2$ | 200 |
| Enlongation at break | ISO 527 | % | 20/30 |
| Traction stretch | ISO 527 | $Kg/cm^2$ | 17.000 |

### PP PHYSICAL FEATURES

| CHARACTERISTICS | TEST | SIZE | RESULT* |
|---|---|---|---|
| Mass volume | ISO 1183 | $Kg/dm^3$ | 0,92 |
| Vicat softening temperature | ISO 306-B | °C | 94 |
| Thermal linear expansion coefficient | / | mm/m°C | 0,15 |

* = Data obtained from tests effected: • Test tube type ISO 1
• Traction speed = 50 mm/min
** = Temperature: • min. 0° • max. 60°

# MATERIALS

## PVC CHEMICAL RESISTANCE

| PRODUCT | CONCENTRATION (%) | TEMP. °C | |
|---|---|---|---|
| | | 20°C | 60°C |
| Acetic Acid | 80 | S | L |
| Acetic Acid Monochloride | SOL | S | L |
| Acetic Aldehyde | 100 | NS | - |
| Acetic Anhydride | 100 | NS | NS |
| Acetone | 100 | NS | NS |
| Adipic Acid | SOL SAT. | S | L |
| Allyl Alcohol | 96 | L | S |
| Aluminum Chloride | SOL SAT | S | S |
| Aluminum Sulphate | SOL SAT | S | S |
| Ammonia (aqueous) | 100 | L | NS |
| Ammonia (gas) | 100 | S | S |
| Ammonia (solution) | SOL DIL | S | L |
| Ammonium Chloride | SOL SAT | S | S |
| Ammonium Fluoride | 20 | S | L |
| Ammonium Nitrate | SOL SAT | S | S |
| Ammonium Sulphate | SOL SAT | S | S |
| Amyl Acetate | 100 | NS | NS |
| Amyl Alcohol | 100 | S | L |
| Aniline | 100 | NS | NS |
| Aniline | SOL SAT | NS | NS |
| Aniline Hydrochloride | SOL SAT | NS | NS |
| Antimony Chloride | 90 | S | S |
| Arsenic Acid | SOL DIL | S | - |
| Beer | | S | S |
| Benzaldehyde | 0.1 | NS | NS |
| Benzene | 100 | NS | NS |
| Benzoic Acid | SOL SAT | L | NS |
| Borax | SOL SAT | S | L |
| Boric Acid | SOL DIL | S | L |
| Bromine (liquid) | 100 | NS | NS |
| Bromine Acid | 10 | S | - |
| Butadiene | 100 | S | S |
| Butane | 100 | S | - |
| Butyl Acetate | 100 | NS | NS |
| Butyl Phenol | 100 | NS | NS |
| Butylene | 100 | S | L |
| Butyric Acid | 20 | S | L |
| Butyric Acid | 96 | NS | NS |
| Calcium Chloride | SOL SAT | S | S |
| Calcium Nitrate | 50 | S | S |
| Carbon Dioxide | 100 | S | S |
| Carbon Sulphide | 100 | NS | NS |
| Carbon tetrachloride | 100 | NS | NS |
| Cetyl Acid | 100 | S | S |
| Chlorine (dry gas) | 100 | L | NS |
| Chlorine (liquid) | SOL SAT | L | NS |
| Chlorosulphonic Acid | 100 | L | NS |
| Chromic Acid | 1-50 | S | L |
| Citric Acid | SOL SAT | S | S |
| Copper Chloride | SOL SAT | S | S |
| Copper Fluoride | 2 | S | S |
| Creosol | SOL SAT | - | NS |
| Cresol Acid | SOL SAT | NS | NS |
| Crotonic Aldehyde | 100 | NS | NS |
| Cyclohexanol | 100 | NS | NS |
| Cyclohexanone | 100 | NS | NS |
| Developing Bath | | S | S |
| Dextrine | SOL SAT | S | L |
| Dichloroethylene | 100 | NS | NS |
| Diglycolic Acid | 18 | S | L |
| Dimethylammine | 30 | S | - |
| Ethyl Acetate | 100 | NS | NS |
| Ethyl Acrylate | 100 | NS | NS |
| Ethyl Alcohol | 95 | S | L |
| Ethyl Ether | 100 | NS | L |
| Ethylene Glycol | CONC. | L | L |
| Fluosilicic Acid | 32 | S | S |
| Formaldehyde | SOL | S | S |
| Formaldehyde | 40 | S | S |
| Formic Acid | 1-90 | S | L |
| Furfural Alcohol | 100 | NS | NS |
| Glucose | SOL SAT. | S | L |
| Glycerin | 100 | S | S |
| Glycolic Acid | 30 | S | S |
| Golden Syrup | SOL | S | L |
| Hydrazine Benzene | 100 | NS | NS |
| Hydrazine Benzene Cloric | 97 | NS | NS |
| Hydrobromic Acid | 50 | S | L |
| Hydrochloric Acid | >30 | S | S |
| Hydrofluoric Acid | 60 | L | NS |

| PRODUCT | CONCENTRATION (%) | TEMP. °C | |
|---|---|---|---|
| | | 20°C | 60°C |
| Hydrogen | 100 | S | S |
| Hydrogen Dioxide | 30 | S | S |
| Hydrogen Sulphide | 100 | S | S |
| Iron Chloride | SOL SAT | S | S |
| Lactic Acid | 10 | S | L |
| Lactic Acid | 10-90 | L | NS |
| Lead Acetate | SOL SAT | S | S |
| Lead Tetraethyl | 100 | S | - |
| Magnesium Chloride | SOL SAT | S | S |
| Magnesium Sulphate | SOL SAT | S | S |
| Maleic Acid | SOL SAT | S | L |
| Methyl Alcohol | 100 | S | L |
| Methyl Methacrylate | 100 | NS | NS |
| Methylene Chloride | 100 | NS | NS |
| Milk | | S | S |
| Nickel Sulphate | SOL SAT | S | S |
| Nicotinic Acid | CONC | S | S |
| Nitric Acid | <40 | S | L |
| Nitric Acid | 40-90 | NS | NS |
| Oils | | S | S |
| Oleic Acid | 100 | S | S |
| Oleum | 10% of SO³ | NS | NS |
| Oxalic Acid | SOL DIL | S | L |
| Oxalic Acid | SOL SAT | S | S |
| Oxygen | 100 | S | S |
| Ozone | 100 | NS | NS |
| Perchloric Acid | 10 | S | L |
| Perchloric Acid | 70 | L | NS |
| Petrol | 80/20 | NS | NS |
| Phenol | 90 | NS | NS |
| Phosphine | 100 | S | S |
| Phosphor Trichloride | 100 | NS | - |
| Phosphoric Acid | 30 | S | L |
| Picric Acid | SOL SAT | S | S |
| Potassium Bichromate | 40 | S | S |
| Potassium Bromide | SOL SAT | S | S |
| Potassium Chloride | SOL SAT | S | S |
| Potassium Chromate | 40 | S | S |
| Potassium Cyanide | SOL | S | S |
| Potassium Ferricyanide | SOL SAT | S | S |
| Potassium Ferrocyanide | SOL SAT | S | S |
| Potassium Hydroxide | SOL | S | S |
| Potassium Nitrate | SOL SAT | S | S |
| Potassium Permanganate | 20 | S | S |
| Potassium Persulfate | SOL SAT | S | L |
| Propane (gas liquid) | 100 | S | - |
| Pyridine | 100 | NS | - |
| Sea Water | | S | L |
| Silver Nitrate | SOL SAT | S | L |
| Soap | SOL | S | L |
| Sodium Benzoate | 35 | S | L |
| Sodium Bisulphite | SOL SAT | S | S |
| Sodium Chloride | SOL SAT | S | S |
| Sodium Ferricyanide | SOL SAT | S | S |
| Sodium Hydroxide | SOL | S | L |
| Sodium Hypochlorite | 100 (12% Cl) | S | L |
| Sodium Sulphite | SOL SAT | S | L |
| Sugar | SOL SAT | S | S |
| Sulphur Acid | SOL | S | S |
| Sulphur Anhydride | 100 (liquid) | L | NS |
| Sulphur Anhydride | 100 (dry) | L | NS |
| Sulphuric Acid | 40-90 | S | L |
| Sulphuric Acid | 96 | L | NS |
| Tannic Acid | SOL | S | S |
| Tartaric Acid | SOL | S | S |
| Tin Chloride | SOL SAT | S | S |
| Toluene | 100 | NS | NS |
| Trichloroethylene | 100 | NS | NS |
| Trimethyl Propane | <10 | S | L |
| Urea | 10 | S | L |
| Urine | | S | L |
| Vinegar | | S | S |
| Vinyl Acetate | 100 | NS | NS |
| Wine | | S | S |
| Xylene | 100 | NS | NS |
| Yeast | SOL | S | L |
| Zinc Chloride | SOL SAT | S | S |

## PP CHEMICAL RESISTANCE

| PRODUCT | CONCENTRATION (%) | TEMP. °C | |
|---|---|---|---|
| | | 20°C | 60°C |
| Acetic Acid | 60 | S | L |
| Acetic Acid Monochloride | SOL | S | L |
| Acetic Aldehyde | 30 | L | NS |
| Acetic Anhydride | 100 | L | NS |
| Acetone | 100 | S | S |
| Adipic Acid | - | - | - |
| Allyl Alcohol | 96 | S | S |
| Aluminum Chloride | SOL SAT. | S | S |
| Aluminum Sulphate | SOL SAT. | S | S |
| Ammonia (gas) | 100 | S | S |
| Ammonia (liquid) | 100 | S | L |
| Ammonia (solution) | SOL DIL | S | L |
| Ammonium Chloride | SOL SAT. | S | S |
| Ammonium Fluoride | - | - | - |
| Ammonium Nitrate | SOL SAT. | S | S |
| Ammonium Sulphate | SOL SAT. | S | S |
| Amyl Acetate | 100 | NS | NS |
| Amyl Alcohol | 100 | S | L |
| Aniline | 100 | S | L |
| Aniline | SOL SAT. | S | L |
| Aniline Hydrochloride | SOL SAT. | - | - |
| Antimony Chloride | 90 | S | S |
| Arsenic Acid | SOL DIL | S | - |
| Beer | | S | S |
| Benzaldehyde | 100 | S | - |
| Benzene | 100 | NS | NS |
| Benzoic Acid | SOL SAT. | S | L |
| Borax | SOL SAT. | S | L |
| Boric Acid | SOL DIL | S | L |
| Bromine (liquid) | 100 | NS | NS |
| Bromine Acid | 10 | S | - |
| Butadiene | 100 | S | S |
| Butane | 100 | S | - |
| Butyl Acetate | 100 | NS | NS |
| Butyl Phenol | 100 | NS | NS |
| Butylene | 100 | S | L |
| Butyric Acid | 20 | S | L |
| Butyric Acid | 96 | NS | NS |
| Calcium Chloride | SOL SAT. | S | S |
| Calcium Nitrate | 50 | S | S |
| Carbon Dioxide | 100 | S | S |
| Carbon Sulphide | 100 | S | - |
| Carbon tetrachloride | 100 | NS | NS |
| Chlorine (dry gas) | 100 | NS | NS |
| Chlorine (liquid) | SOL SAT. | NS | NS |
| Chlorosulphonic Acid | 100 | NS | NS |
| Chromic Acid | | - | - |
| Citric Acid | SOL SAT. | S | S |
| Copper Chloride | SOL SAT. | S | S |
| Copper Fluoride | 2 | S | S |
| Creosol | 100 | L | NS |
| Cresol Acid | SOL SAT. | NS | NS |
| Crotonic Aldehyde | 100 | NS | NS |
| Cyclohexanol | 100 | L | NS |
| Cyclohexanone | 100 | L | NS |
| Developing Bath | | S | S |
| Dextrine | SOL SAT. | - | - |
| Dibutyl Phthalate | 100 | NS | L |
| Dichloroethylene | 100 | NS | NS |
| Diglycolic Acid | 18 | S | L |
| Dimethylammine | 30 | S | - |
| Ethyl Acetate | 100 | NS | NS |
| Ethyl Alcohol | 95 | S | L |
| Ethyl Benzene | 100 | NS | NS |
| Ethyl Ether | 100 | S | - |
| Ethylene Glycol | CONC. | S | S |
| Fluorine | 100 | NS | NS |
| Formaldehyde | SOL DIL | S | S |
| Formaldehyde | 40 | S | S |
| Formic Acid | 1-90 | L | NS |
| Furfural Alcohol | 100 | NS | NS |
| Glucose | SOL SAT. | S | L |
| Glycerin | 100 | S | S |
| Glycolic Acid | 30 | S | S |
| Golden Syrup | SOL | S | L |
| Hydrobromic Acid | 50 | - | - |
| Hydrochloric Acid | 30 | L | NS |
| Hydrofluoric Acid | 60 | L | NS |

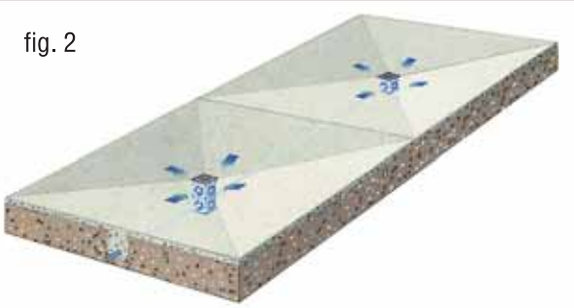
| PRODUCT | CONCENTRATION (%) | TEMP. °C | |
|---|---|---|---|
| | | 20°C | 60°C |
| Hydrogen | 100 | S | S |
| Hydrogen Dioxide | 30 | S | L |
| Hydrogen Sulphide | 100 | S | S |
| Isooctane | 100 | L | S |
| Lactic Acid | 10 | S | L |
| Lactic Acid | 10-90 | L | L |
| Lead Tetraethyl | 100 | S | - |
| Magnesium Sulphate | SOL SAT. | S | S |
| Maleic Acid | SOL SAT. | S | L |
| Methyl Alcohol | 100 | S | L |
| Methyl Methacrylate | 100 | NS | NS |
| Methylene Chloride | 100 | NS | NS |
| Milk | | S | S |
| Mineral Oil | 100 | L | L |
| N-Heptane | 100 | L | NS |
| Nickel Sulphate | SOL SAT. | S | S |
| Nicotinic Acid | CONC. | S | S |
| Nitric Acid | <25 | L | NS |
| Nitric Acid | 50 | NS | NS |
| Oleic Acid | 100 | L | L |
| Oleum | 10% of SO³ | NS | NS |
| Oxalic Acid | 25 | S | L |
| Oxalic Acid | SOL SAT. | L | L |
| Oxygen | SOL SAT. | L | L |
| Petrol | 80/20 | NS | NS |
| Petroleum | 100 | L | NS |
| Phenol | SOL SAT. | S | S |
| Phosphine | 100 | S | L |
| Phosphor Oxichloride | 100 | L | L |
| Phosphoric Acid | 30 | S | L |
| Potassium Bichromate | SOL 20 | S | S |
| Potassium Bromide | SOL SAT. | S | S |
| Potassium Chloride | SOL SAT. | S | S |
| Potassium Chromate | 40 | S | S |
| Potassium Cyanide | SOL | S | S |
| Potassium Ferricyanide | SOL SAT. | S | S |
| Potassium Ferrocyanide | SOL SAT. | S | S |
| Potassium Hydroxide | SOL | S | S |
| Potassium Nitrate | SOL SAT. | S | L |
| Potassium Permanganate | 20 | S | S |
| Potassium Persulfate | SOL SAT. | S | L |
| Propane (gas liquid) | 100 | S | - |
| Propionic Acid | 50 | S | S |
| Pyridine | 100 | NS | NS |
| Sea Water | | S | L |
| Silver Nitrate | SOL SAT. | S | L |
| Soap | SOL | S | S |
| Sodium Bisulphite | SOL SAT. | S | S |
| Sodium Chloride | SOL SAT. | S | S |
| Sodium Chromate | SOL SAT. | S | S |
| Sodium Ferricyanide | SOL SAT. | S | S |
| Sodium Hydroxide | SOL | S | S |
| Sodium Hypochlorite | 20 | L | NS |
| Sodium Hypochlorite | 100 (13% Cl) | S | L |
| Sodium Silicate | SOL | S | S |
| Sodium Sulphite | SOL SAT. | S | L |
| Sulphur Acid | SOL | S | S |
| Sulphur Anhydride | 100 (liquid) | S | L |
| Sulphur Anhydride | 100 (dry) | L | NS |
| Sulphuric Acid | 40-90 | L | L |
| Sulphuric Acid | 96 | NS | NS |
| Sulphuric Chloride | 100 | NS | NS |
| Sulphuryl Chloride | 100 | NS | NS |
| Tannic Acid | SOL | S | S |
| Tartaric Acid | SOL | S | S |
| Tetrachloroethene | 100 | NS | NS |
| Thiophene | 100 | L | L |
| Tin Chloride | SOL SAT. | S | S |
| Toluene | 100 | NS | NS |
| Trichloroethylene | 100 | NS | NS |
| Turpentine (oil) | 100 | NS | NS |
| Urea | 10 | S | L |
| Vaseline | | L | L |
| Vinegar | | S | S |
| Vinyl Acetate | 100 | NS | NS |
| Wine | | S | S |
| Xylene | 100 | NS | NS |
| Yeast | SOL | S | L |

## SOIL DRAINAGE

Rain, like all natural phenomenons that daily impact man life,has to be quantified and be kept under control. Floor drainage is the activity linked to meteoric waters gathering and channelling. Nowadays, rainfalls changes (in strength, frequency and timing) and the growing water lack are making this activity more and more crucial for the everyday life quality. EUROPLAST proposes a wide range of new drainage accessories in PVC, PP and ABS, characterized for being light, easy to be installed, atmospheric and chemical agents resistant.
The range includes accessories to drain both localized and linear, related to soil width, to pluviometric intensity and frequency, to architectural choices, and to site destination.

fig. 1

fig. 2



### LOCALIZED EVACUATION

This kind of evacuation is mainly considered when it is necessary to gather water trapping every single evacuation point.
In this way, using small drainage accessories called floor drains (see fig. 1), a small excavation will be enough to convoy water, especially in low excavation width areas like garages, terraces, etc.
The localized evacuation is often adopted for aesthetical reasons too, because it is possible to place drains in hidden or definite site. In this way catch basins with walkway and light traffic grills are the best solution for areas with no trucks or industrial vehicles passage, because they are designed to optimize transport and installation of the whole drainage system (see fig. 1-2).
To get the best performance in a localized evacuation system it is important to:

- calculate number of accessories to be used considering pluviometric intensity, hydraulic discharge of chosen item and roughness of the area to be drained
- divide the whole area into several squares as the number of localized evacuation points
- install the catch basin at the centre of the mentioned drainage points
- keep all the 4 levels of each square with a slight slope inward.

### LINEAR EVACUATION

All the underground connectors for rain gathering can be partially substituted by superficial drainage channels with grills. These channels can be placed in flat open areas without digging limitations. Linear drainage system permits an easier installation than localized one, because it is less difficult to project the drainage plane.
All ground drained in this way are flatter and more suitable for vehicular traffic. Both evacuation systems are efficient in case of meteoric water gathering.
There are particular cases, when water reaches drainage area with high speed (like for example in a swimming pool border or between underground garages and ramps or along borders with slope changes), in which it is necessary to gather water for a wide area set at 90° of the flow direction.
EUROPLAST proposes its range of channels with walkway and light traffic grills (A15, B125, C250 load classes) to get an efficient linear evacuation.

fig. 3

## DRAINAGE NETWORKS CALCULATION

To establish the correct size of drainage networks it is important to consider the following parameters:

- rain flow to be evacuated — Qt (l/sec)
- area to be drained — ($m^2$)
- rain intensity — (mm/hour)
- ground morphology and slope
- Flow rate of the selected item — Qt (l/sec)

In the figure 4 it is possible to link together area to be drained, pluviometric intensity and rain discharge to be evacuated.

For example:

| | |
|---|---|
| Rain intensity | = 75 mm/hour |
| A Length of area to be drained | = 20 m |
| B Breadth of area to be drained | = 15 m |
| Selected item for drainage  | = Floor drain internal outlet 04869 (250x250, outlet Ø100, 3,0 l/s certified flow rate) |
| N° of floor drains to be installed | = ? |

1) total area calculation: Area = AxB = 20x15 = 300 $m^2$

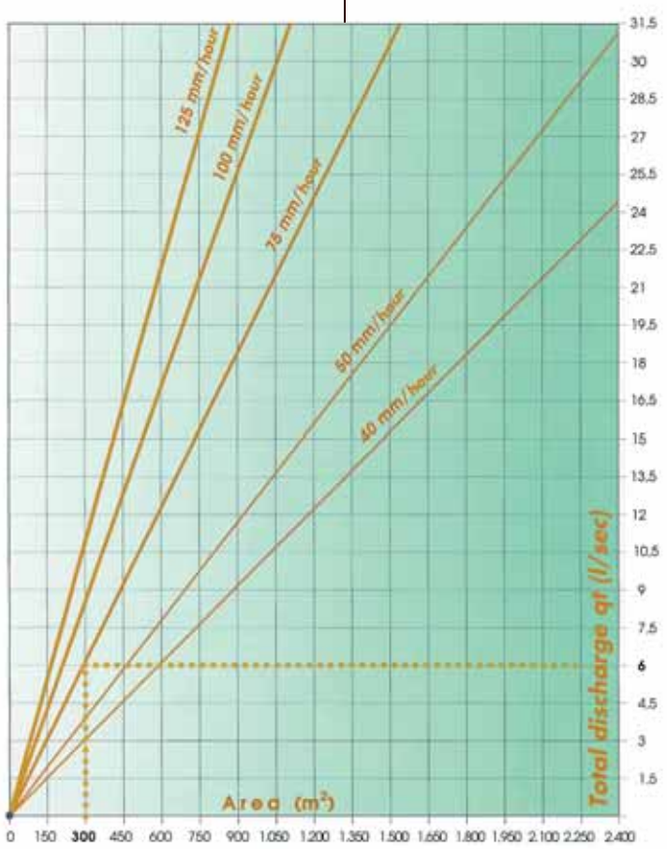
2) Research in picture 4 of correspondence between area, pluviometric intensity line and related total hydraulic discharge of rain to be evacuated: about 6 l/s

3) Divide the total hydraulic discharge by single chosen item hydraulic discharge and you will find the total number of floor drains to be placed in the area:

N° floor drains = Qt : Qe = 6 : 3 = 2

Estimate of the total rainwater quantity in the area is the key issue in measuring drainage networks. Data in picture 4 are average results and they are not influenced by external factors (slope and surface characteristics) which can have a relevant impact on these results.

fig. 4




## RAINFALL IN THE WORLD

| State | City | Rainy months* (mm) | Rainy days* | Month* |
|---|---|---|---|---|
| ARGENTINA | Buenos Aires | 120 | 8 | March |
| BOLIVIA | La Paz | 90 | 21 | January |
| CANADA | Calgary | 90 | 13 | June |
| CHILE | Santiago | 85 | 6 | June |
| CHINA | Lanzhou | 29 | 16 | July |
| CUBA | Havana | 170 | 11 | October |
| DANIMARK | Copenhagen | 70 | 11 | July |
| PHILIPPINES | Manila | 480 | 22 | August |
| FRANCH | Perpignan | 85 | 7 | December |
| JORDAN | Al Aqaba | 8 | 1 | December |
| UNITED KINGDOM | Edimburgh | 85 | 12 | July |
| GREECE | Athens | 70 | 9 | December |
| INDIA | New Delhi | 210 | 12 | July |
| IRAN | Teheran | 44 | 4 | January |
| IRELAND | Dublin | 75 | 14 | December |
| ICELAND | Reykjavik | 95 | 14 | October |
| KENYA | Nairobi | 190 | 18 | May |
| MOROCCO | Marrakech | 35 | 8 | December |
| MEXICO | Mexico City | 160 | 17 | July |
| NEPAL | Kathmandu | 375 | 21 | July |
| NORWAY | Troms | 115 | 16 | October |
| PERU | Lima | 2 | 1 | July |
| POLAND | Warsaw | 90 | 11 | July |
| SPAIN | Granada | 70 | 10 | December |
| USA | Los Angeles | 75 | 4 | February |
| USA | Phoenix | 25 | 3 | February |
| SOUTH AFRICA | Durban | 130 | 9 | February |
| THAILAND | Chiang Mai | 290 | 18 | September |
| TURKEY | Ankara | 50 | 7 | May |
| RUSSIA | Taskent | 80 | 9 | March |
| VENEZUELA | Caracas | 110 | 13 | July |
| VIETNAM | Hanoi | 355 | 16 | August |

*Data referred to highest monthly rainfall registered during the year.

# TECHNICAL SPECIFICATIONS

During installation of catch basins and grills it is important to consider the following 2 parameters:

1) **hydraulic discharge of pipelines connecting catch basins and sewage network (litres/second)**
2) **hydraulic discharge of grills placed on catch basins (litres/seconds)**

Hydraulic discharge of pipelines depends on pipe diameter, slope and roughness. Roughness in particular can influence the hydraulic discharge, because pipelines dirtied by using slow down flow, especially with small slopes.
In this way it is important to link the right pipeline (see table A) with the suitable hydraulic discharge grill (table B) to obtain a balanced evacuation.
Linear evacuation is more complex. For grill evacuation you can consider table A hydraulic discharge multiplied by the number of grills.

Pluviometer

Weather station

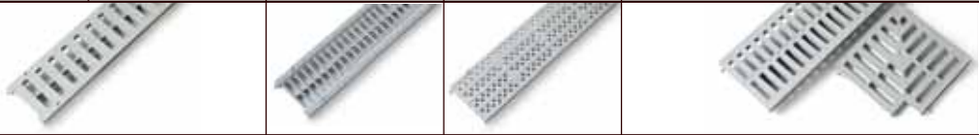
It is important to link the suitable hydraulic discharge grill (table B) with the right pipeline (see table A) to obtain a balanced evacuation. In case hydraulic discharge is higher than pipeline one it will be necessary to connect several different evacuation points.

TABLE A

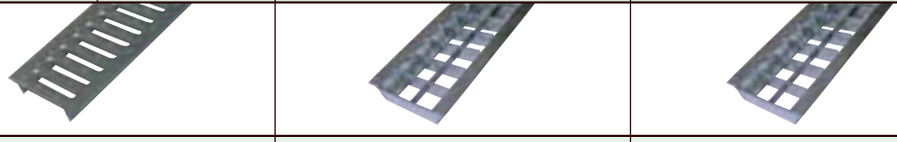
| PIPES FLOW RATE (l/s) WITH DIFFERENT SLOPES | | | | | | | |
|---|---|---|---|---|---|---|---|
| PVC PIPE DIAMETER mm | SLOPE % 0,5% | 1% | 1,5% | 2% | 3% | 5% | 10% |
| 40 | 0,15 | 0,26 | 0,30 | 0,35 | 0,43 | 0,57 | 0,80 |
| 50 | 0,37 | 0,52 | 0,60 | 0,73 | 0,89 | 1,14 | 1,61 |
| 63 | 0 ,73 | 1,04 | 1,28 | 1,47 | 1,77 | 2,28 | 3,16 |
| 75 | 1,21 | 1,63 | 2,10 | 2,41 | 2,94 | 3,80 | 5,35 |
| 80 | 1,44 | 2,05 | 2,51 | 2,88 | 3,54 | 4,56 | 6,44 |
| 100 | 2,78 | 3,91 | 4,78 | 5,57 | 6,78 | 8,75 | 12,34 |
| 125 | 5,20 | 7,36 | 8,99 | 10,40 | 13,00 | 16,41 | 23,19 |
| 140 | 6,91 | 9,78 | 11,96 | 13,80 | 16,90 | 21,81 | 30,93 |
| 160 | 9,80 | 13,74 | 16, 86 | 19,46 | 23,86 | 30,76 | 43,57 |
| 200 | 16,94 | 24,01 | 29,40 | 33,96 | 41,61 | 53,70 | 75,78 |
| 250 | 30,09 | 42,54 | 52,06 | 60,15 | 73,64 | 95,10 | 134,60 |
| 315 | 54,48 | 77,11 | 94,32 | 108,90 | 133,40 | 172,00 | 244,50 |

TABLE B

| GRILL | 200x200 | 300x300 | 350x350 | 400x400 | 450x450 | 550x550 |
|---|---|---|---|---|---|---|
| FLOW RATE (l/s) | 1,7 • | 2,8 • | 3,3 • | 3,8 | 4,1 | 4,6 • |



| GRILL | 130x500 11 tons | 130x500 5 tons | 130x500 high drainage | 130x500 swimming pool | 200x500 light traffic |
|---|---|---|---|---|---|
| FLOW RATE (l/s) | 1,9 | 2,1 | 3,6 | 1,2 | 2,8 |



| GRILL | galvanized steel grill load class A15 | galvanized steel grill load class B125 square mesh 33 x 33 | galvanized steel grill load class C250 square mesh 33 x 33 |
|---|---|---|---|
| FLOW RATE (l/s) | 2,3 | 7,9 | 7,5 |

## LINEAR EVACUATION

In case of linear evacuation drainage channels are chosen both for granted load resistance and for water quantity to be drained.

## ESTIMATE OF QUANTITY OF WATER TO BE DRAINED

| | |
|---|---|
| Qt | = quantity of water to be drained |
| A | = area to be drained |
| P | = average quantity of rainfall |
| Qt | = A x P |

For example considering daily highest rainfall tables it is possible to determine the quantity of water to be drained over an area 10x5 mt characterized by a daily highest rainfall value between 90 mm/day - 120 mm/day (minimum-maximum):

| | |
|---|---|
| Area | = 10 x 5 mt = 50 mt$^2$ |
| Hypothetical average rainfall estimated | = 105 mm/hour |
| Qt | = 50 x 105 = 5.250 mm/hour |

5.250 mm/hour corresponding to 1,46 mm/second (1,46 l/s).

## ESTIMATE OF CHANNELS HYDRAULIC DISCHARGE

Channels hydraulic discharge have been calculated supposing hydraulic discharge (Q) has uniform motion. Chézy's formula permits to calcolate respectively Speed (V) and Hydraulic discharge (Q):

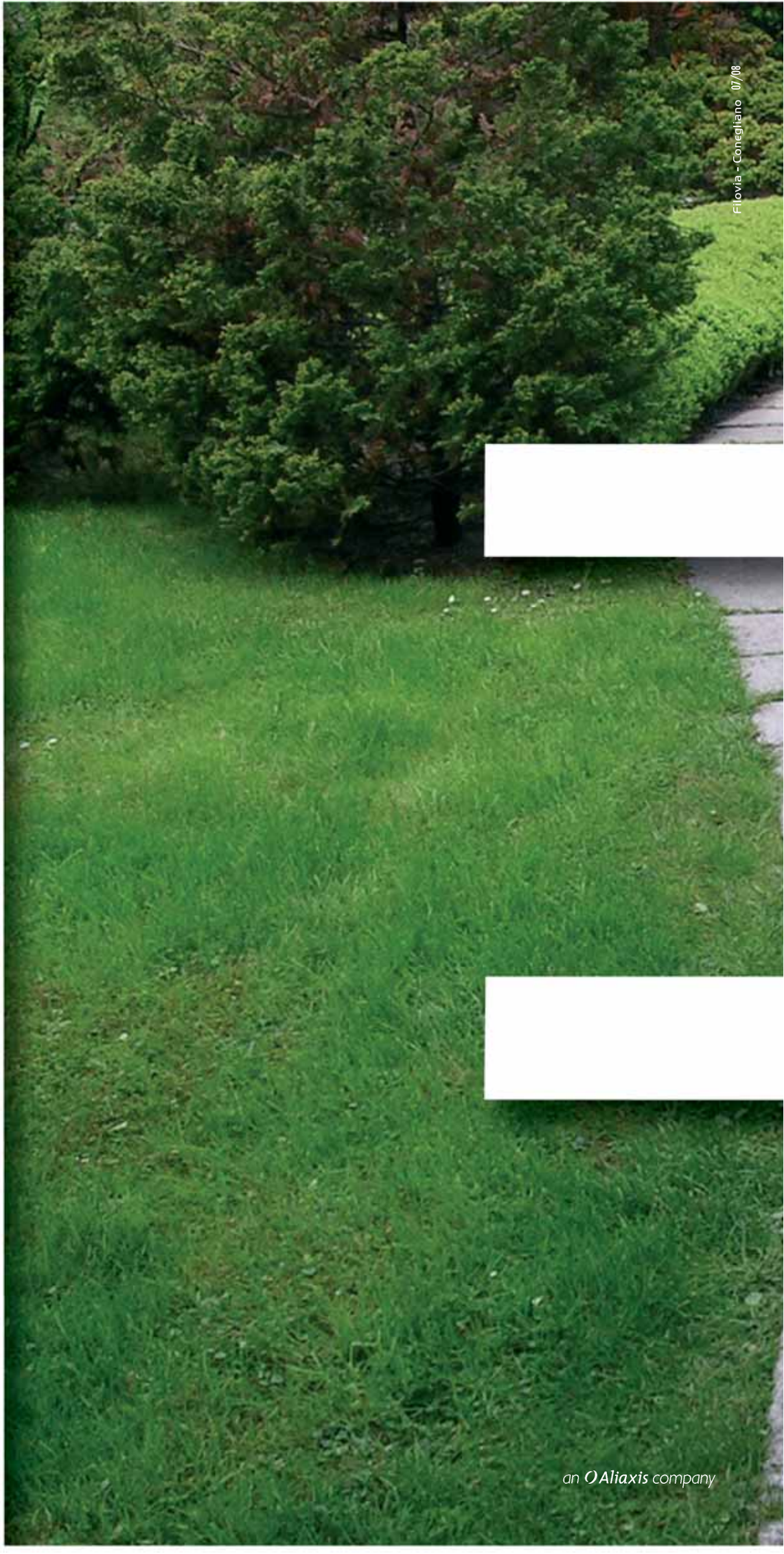
$Q = AxV$
$V = C\sqrt{(Rxi)}$

Coefficient C can be calculated with Bazin's formula $C = 87 / (1+\gamma/\sqrt{R})$ where A is the section, R is the average radius of the channel and $\gamma$ is the roughness coefficient of the internal channel surface. As indicated in the table on the side the roughness coefficient of plastics (PVC and PP) is much lower if compared with other materials.

Grills flow discharge (page 09) has to be linked with channels flow discharge in table below.
If hydraulic discharge is higher than channels one other vertical or lateral pipes can be connected to the channels, improving the hydraulic discharge of the all system.

| CHANNEL DESCRIPTION | BAZIN $\gamma$ (m$^{1/2}$) |
|---|---|
| Channel made of PVC, PP, PE | 0,02 |
| Channels made of concrete. | 0,10 |
| Channels made of concrete (low level of maintenance) | 0,23 ÷ 0,36 |
| Channels made of stone. | 0,46 |
| Channels made of concrete with grass on the bottom. | 1,30 |
| Abandoned channels with vegetation. | 2,0 ÷ 2,3 |

| flow rate (l/s) with different slopes | h (mm) | roughness PVC - PP | 0,5% | 1,0% | 1,5% | 2,0% | 3,0% | 4,0% | 5,0% | 10% |
|---|---|---|---|---|---|---|---|---|---|---|
|  | 52 (130x1000) | 0,02 | 1,4 | 2,0 | 2,5 | 2,9 | 3,5 | 4,1 | 4,6 | 6,5 |
|  | 70 (130x1000) | 0,02 | 2,3 | 3,3 | 4,0 | 4,6 | 5,7 | 6,6 | 7,3 | 10,4 |
|  | 130 (130x1000) | 0,02 | 4,8 | 6,8 | 8,3 | 9,6 | 11,7 | 13,5 | 15,1 | 21,4 |
|  | 50 (100x500) | 0,02 | 0,5 | 0,7 | 0,9 | 1,0 | 1,3 | 1,4 | 1,6 | 2,3 |
|  | 70 (130x500) | 0,02 | 1,0 | 1,4 | 1,7 | 1,9 | 2,4 | 2,8 | 3,1 | 4,4 |
|  | 134 (130x500) | 0,02 | 3,3 | 4,7 | 5,7 | 6,6 | 8,1 | 9,4 | 10,5 | 14,8 |
|  | 94 (200x500) | 0,02 | 3,5 | 5,0 | 6,1 | 7,0 | 8,6 | 9,9 | 11,1 | 15,7 |
|  | 170 (200x500) | 0,02 | 9,6 | 13,6 | 16,6 | 19,2 | 23,5 | 27,2 | 30,4 | 43,0 |

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