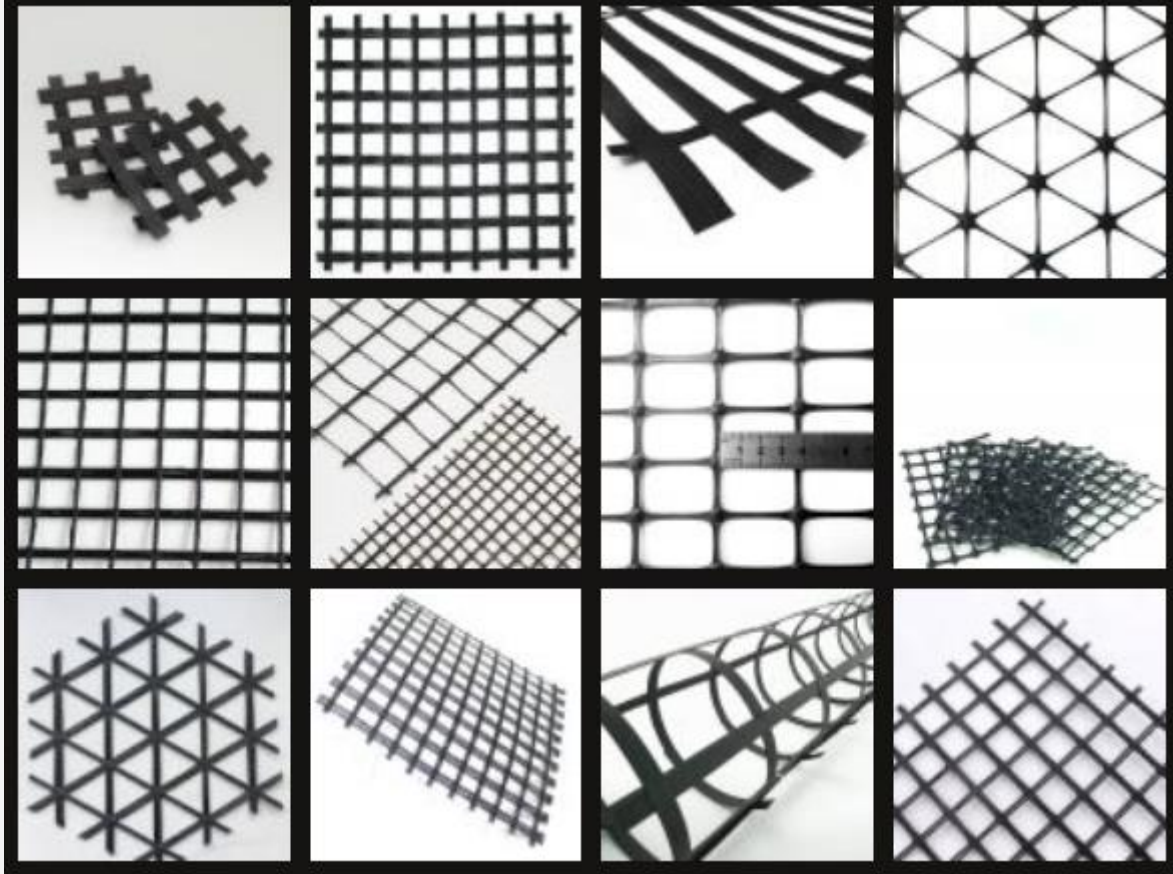




GEOGRID



TME Grup Geogrids: Enhancing Infrastructure Stability and Sustainability

Geogrids play a crucial role in modern infrastructure projects, offering robust solutions for enhancing the stability, durability, and sustainability of civil engineering works. These specialized geosynthetic materials are engineered with high-strength polymers, strategically designed to distribute loads and reinforce various construction materials such as soils, aggregates, and asphalt.

Key Features and Benefits:

Strength and Durability: Geogrids are manufactured from polymeric materials with exceptional tensile strength and durability, ensuring longevity and reliable performance in demanding environments.

Soil Reinforcement:

By interlocking with soil particles, geogrids create a mechanically stabilized layer that improves load distribution, reduces settlement, and enhances bearing capacity.

Erosion Control:

Geogrids effectively prevent soil erosion by stabilizing slopes, embankments, and retaining walls, thereby safeguarding the integrity of infrastructure against natural forces.

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**Cost Efficiency:**

Their lightweight and easy installation properties contribute to cost savings in construction projects, reducing material usage and construction time.

Environmental Sustainability:

Geogrids promote sustainable practices by minimizing excavation needs, preserving natural resources, and extending the service life of infrastructure.

Applications:

Geogrids find extensive applications across various sectors including:

Road Construction: Enhancing the structural integrity of road bases and pavements.

Railway Infrastructure: Strengthening track beds and stabilizing embankments.

Retaining Walls: Supporting earth structures and preventing soil erosion.

Landfills: Providing stability and reinforcement for waste containment facilities.

Mining: Reinforcing mine haul roads and tailings dams.

Conclusion:

In conclusion, geogrids represent a critical component of modern engineering solutions, offering unparalleled benefits in infrastructure development, environmental protection, and cost-effective construction practices. As the demand for sustainable and resilient infrastructure grows, geogrids continue to play a pivotal role in shaping the future of civil engineering worldwide.



GEOTEXTILE



TME Grup Geotextiles: Enhancing Geotechnical Engineering Solutions

Geotextiles represent a fundamental class of geosynthetic materials utilized extensively in civil engineering and environmental applications. These engineered fabrics, available in woven and non-woven varieties, provide essential functionalities such as filtration, separation, reinforcement, and erosion control in a wide range of infrastructure projects.

Key Features and Benefits:

Filtration and Drainage: Geotextiles effectively filter soil particles while allowing water to pass through, preventing clogging in drainage systems and maintaining soil stability.

Separation: By acting as a barrier between different soil layers or between soil and other materials, geotextiles prevent mixing and maintain the integrity of structural components.

Reinforcement: Geotextiles enhance the mechanical properties of soils and aggregates, improving load distribution and increasing the bearing capacity of weak or unstable ground.

Erosion Control: Used in slope stabilization, embankment protection, and shoreline erosion prevention, geotextiles mitigate the impact of water flow and reduce surface erosion.

Types of Geotextiles:

Woven Geotextiles:

Constructed by weaving individual yarns together to form a strong and durable fabric.

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Ideal for applications requiring high tensile strength and puncture resistance, such as road stabilization and reinforcement of retaining walls. Compliant with industry standards like ASTM D4751 (Standard Test Method for Determining Apparent Opening Size of a Geotextile).

Non-Woven Geotextiles:

Made by mechanically bonding fibers together through needle-punching or thermal processes. Provide excellent filtration and drainage properties, making them suitable for use in filtration systems and separation layers. Conform to standards such as ASTM D4491 (Standard Test Methods for Water Permeability of Geotextiles by Permittivity).

Applications:

Geotextiles find diverse applications across various sectors, including:

Road Construction: Separation and stabilization of soil layers, reinforcement of pavements, and drainage enhancement.

Environmental Engineering: Landfill liners, erosion control blankets, and coastal protection systems.

Water Management: Canal and reservoir lining, filtration in stormwater management, and reinforcement in dam construction.

Standards and Quality Assurance:

Geotextiles manufactured and tested according to recognized standards ensure reliability and performance consistency across projects. Key standards include ASTM, ISO (International Organization for Standardization), and GRI (Geosynthetic Research Institute) guidelines, which govern aspects such as material properties, durability, and installation practices.

Conclusion:

In summary, geotextiles play a pivotal role in modern geotechnical engineering by providing versatile solutions for filtration, separation, reinforcement, and erosion control. Whether woven or non-woven, these geosynthetic materials contribute to sustainable infrastructure development and environmental stewardship worldwide.

For further information on selecting the right geotextile for your specific project requirements, contact us to explore our comprehensive range of geotechnical solutions.

GEOTEXTILE

Non-Woven & Woven Fabric

Geotextiles are permeable fabrics, made from either polypropylene or polyester. When used in several different applications, mainly associated with soil, geotextiles have the ability to separate, filter, reinforce, protect, or drain. Geotextile fabrics come in three basic forms: non-woven geotextiles, woven geotextiles (needle punched), or heat bonded geotextiles (structural woven).

Common Applications of Geotextiles

Separation	Filtration	Drainage
Reinforcement	Protection	Insulation

PET geotextiles have high tensile strength at very low strain. High tensile strength at very low elongation. PET geotextiles can reach over 1200kN/m in uniaxial direction as the main loading direction and up to 300kN/m x 300kN/m in bi-axial directions, and the strength is generated typically at the strains less than 10%. Furthermore, our Non-Woven and Woven Geotextiles Fabric have excellent CBR value, demonstrating its outstanding ability to be a reinforcement component.



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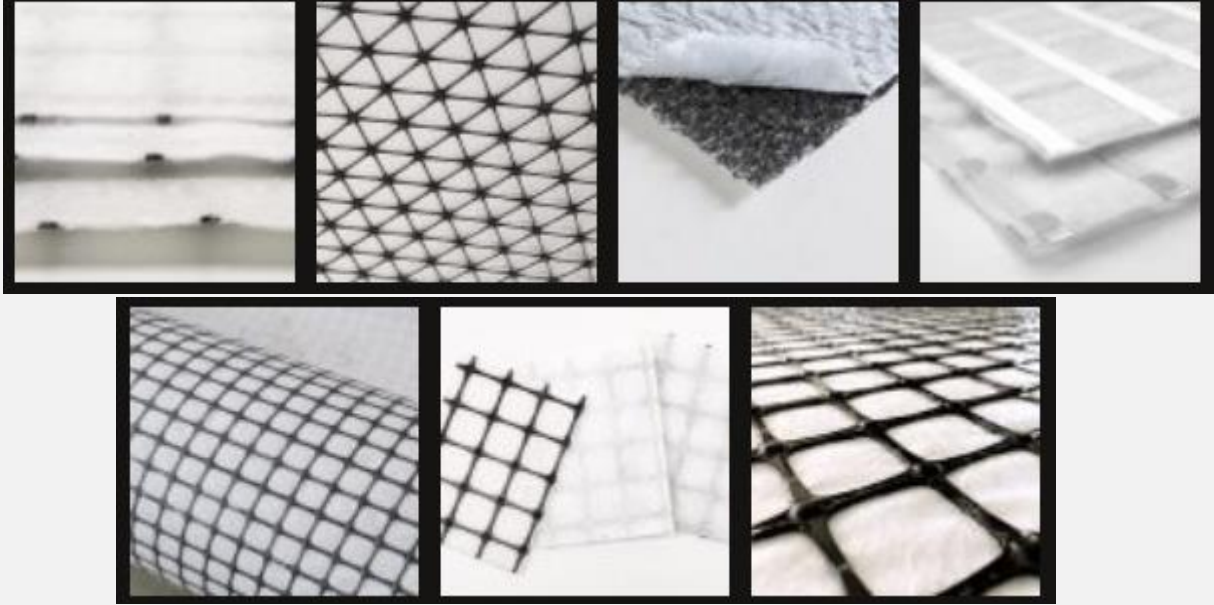
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GEOCOMPOSITE



TME Grup Geocomposites: Innovative Solutions for Integrated Geotechnical Applications

Geocomposites represent a cutting-edge advancement in geosynthetic engineering, combining multiple functions into one versatile material. These composite materials integrate various geosynthetic components such as geotextiles, geogrids, and geomembranes, each tailored to enhance specific aspects of geotechnical performance.

Key Features and Benefits:

Multifunctionality: Geocomposites combine the functionalities of different geosynthetic materials, offering solutions for filtration, drainage, separation, reinforcement, and erosion control in a single product.

Customizable Design: Tailored to meet specific project requirements, geocomposites are available in various configurations, allowing engineers to optimize performance and durability.

Enhanced Performance: By integrating complementary materials, geocomposites improve efficiency in construction, reduce installation time, and enhance overall project sustainability.

Versatility: Suitable for a wide range of applications including road and railway construction, landfill engineering, environmental remediation, and hydraulic infrastructure projects.

Environmental Sustainability: Geocomposites contribute to environmental preservation by minimizing material usage, reducing carbon footprint, and promoting long-term infrastructure stability.

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Applications:

Geocomposites are utilized across diverse sectors, including:

Drainage Systems: Improving water flow and soil consolidation in roadways, retaining walls, and landfills.

Geomembrane Protection: Providing cushioning and protection for geomembranes in containment systems and environmental liners.

Soil Stabilization: Reinforcing weak soils and preventing erosion in steep slopes and embankments.

Gas Venting: Facilitating the release of gases in landfill applications, ensuring safety and compliance with environmental regulations.

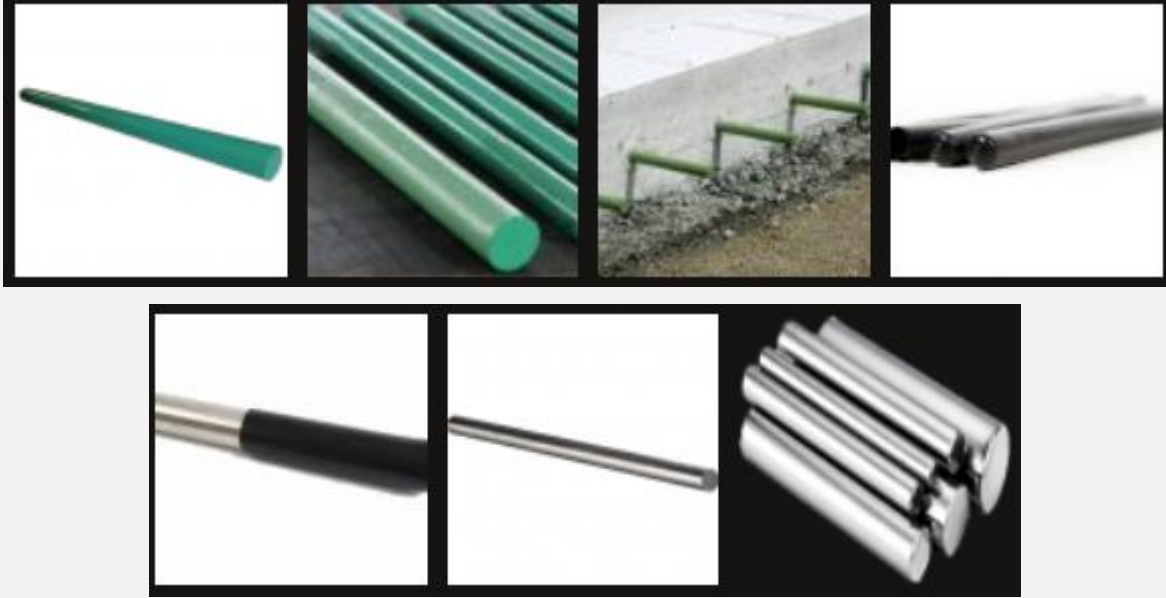
Conclusion:

In summary, geocomposites represent a pivotal advancement in geotechnical engineering, offering tailored solutions to meet the complex challenges of modern construction and environmental stewardship. Their multifunctional capabilities and sustainable benefits position geocomposites as indispensable components in the development of resilient and efficient infrastructure worldwide.

For further details on integrating geocomposites into your next project, contact us today to explore how our innovative solutions can elevate your engineering initiatives.



RETROFIT DOWEL BAR



TME Grup Dowelbars: Enhancing Concrete Pavement Performance

Dowelbars are essential components in concrete pavement construction, designed to improve load transfer efficiency between adjoining slabs and mitigate stresses caused by traffic loads. These cylindrical steel bars are strategically placed across transverse joints to enhance the structural integrity and longevity of concrete pavements, ensuring smooth and durable road surfaces.

Key Features and Benefits:

Load Transfer Efficiency: Dowelbars facilitate effective load transfer between adjacent concrete slabs, reducing joint deflection and preventing pavement cracking.

Enhanced Durability: By minimizing differential settlement and pavement heaving, dowelbars contribute to prolonged pavement life and reduced maintenance costs.

Corrosion Resistance: Manufactured from high-quality steel with corrosion-resistant coatings, dowelbars offer long-term performance and reliability in diverse environmental conditions.

Standard Compliance: Dowelbars adhere to rigorous industry standards such as ASTM A615/A615M (Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement) and ASTM A996/A996M (Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement).

Applications:

Dowelbars are extensively used in various concrete pavement applications, including:

Highways and Roads: Ensuring smooth transitions and maintaining pavement integrity under heavy traffic loads.

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Airport Runways: Providing structural support and load transfer capability for aircraft movements.

Industrial Flooring: Enhancing durability and minimizing joint maintenance in warehouses and manufacturing facilities.

Installation and Maintenance:

Proper installation techniques, including accurate placement and alignment of dowelbars, are critical to maximizing their effectiveness. Regular inspection and maintenance help extend pavement service life by identifying potential issues early and implementing timely repairs.

Conclusion:

In conclusion, dowelbars play a crucial role in optimizing the performance and longevity of concrete pavements, offering efficient load transfer and minimizing maintenance requirements. Compliance with industry standards ensures reliability and consistency across infrastructure projects, reinforcing their importance in sustainable and resilient pavement solutions.

For more information on incorporating dowelbars into your construction projects, contact us today to explore our comprehensive range of high-quality dowelbar solutions.

DOWEL BAR

Epoxy-Coated Dowel Bars protect by using various mechanism. Epoxy-Coated Dowel Bars have shown that the corrosion rates of Steel Reinforcement Rods is 40 to 50 times lower than similar uncoated bars.

Epoxy-Coated rebar can be used in any concrete that is exposed to corrosive conditions. These may include exposure to de-icing salts or seawater.



FEATURES

Epoxycoated

Simple geometry of the formation of the joint without the need of additional measurement or adjustment

Simple formwork and time saving installation

Significantly improves the performance of road connections

Prefabricated leave-in-place cages, for positioning dowels at the correct height and spacing in the slab

Reduces the life cycle cost

Production method of Epoxy-Coated Dowel Bars is being regarding ASTM standards Material Standards are ; ASTM A615/A 615M, ASTM A675/A 675M, ASTM A706/A 706M ASTM A1035/A 1035M

Diameter sizes are between 12mm to 80 mm

It is possible to produce special diameters regarding request of customer

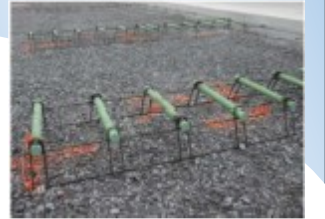
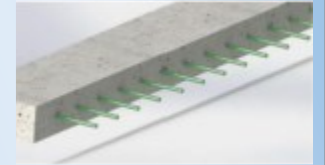
Dowel Bars are produced within the requested yield-tensile-breakage values standards Epoxy Coation standards are ASTM A775/A775M



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GROUND EQUIPMENT - 1

ANCHORAGE

High-strength reinforcement threading machines enable flawless thread cutting in every quality of rebar.

Diameter (mm) 12-40

Length(mm) 38-80

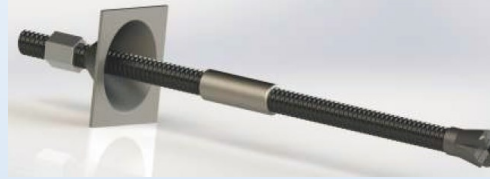


SELF DRILLING ROCK BOLT

The self-drilling anchor bolt device (Threaded Hollow Bars) makes your job much easier, as it is capable of performing procedures of drilling, anchoring and injection all at once.

Diameter (mm) 32-51

Tensile Load (kN) 280-800



ANCHOR BOLT

Our Anchor Bolt Reinforcement Anchor Systems used to anchor the concrete or steel structures and machinery to concrete base structures.

Diameter (mm) 12-40

Length(mm) 120-2000



TIEROD

Tie-Rot (rod-shaft) is a tensioning shaft system used to prevent mold opening in curtain and column molds. Reduces risk in mold construction, improves strength and reliability.

Diameter (mm) 17-24

Strenght (kN) 615-30

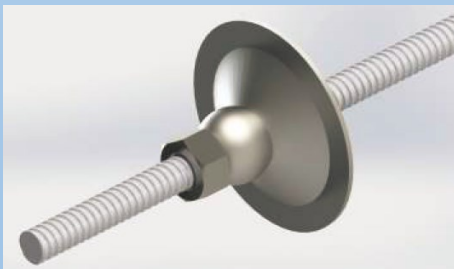


ROCK BOLT

Our Rockbolt ia a unique combination rock bolt system. it offers the combined advantages of anchoring and then a fully filled rock bolt at the same time.

Diameter (mm) 14-82

Strenght (kN) 62-4.418



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GROUND EQUIPMENT - 2



TUNNEL SUPPORT EQUIPMENT

We can supply all type of tunnel support equipment. Rock Bolts and Anchorage, Lattice Girder, Tunnel Lining, Mold Lining and Profile Lining (Profile Arch).



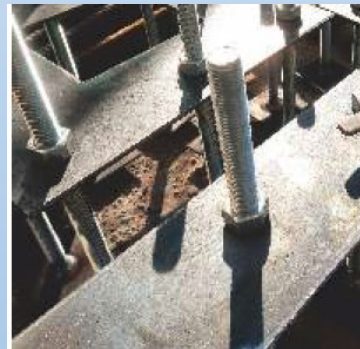
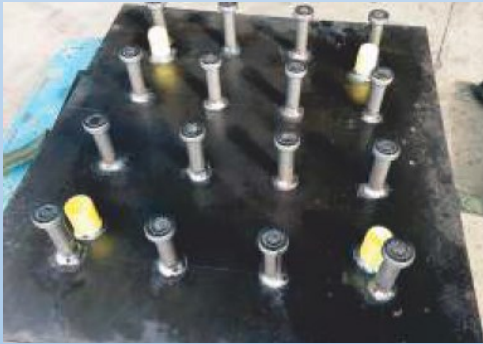
SOIL NAIL

Soil nailing is typically used to stabilize the slopes or excavations where the top/down structure is more advantageous in comparison with other retaining wall systems.



POST TENSIONING

Post tensioning is a concrete reinforcement technique. Post tensioning tendons which provides pre-tensioning of steel ropes inside the plastic channels or couplers are placed in the forms before placing the concrete.



PLATES

Our Plates are designed to transfer heavy loads in the load-bearing structures of the concrete frame. have various sizes from 50 mm x 50 mm to 600 mm x 600 mm, which meets all standard anchorage needs.



PRE-TENSION

The self-drilling anchor bolt device (Threaded Hollow Bars) makes your job much easier. as it is capable of performing procedures of drilling, anchoring and injection all at once.

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GROUND EQUIPMENT - 3



NEW GENERATION ANCHOR

We offer fast and precise anchorage solutions to your connections with the new generation Hybrid Anchor systems.



NUT / WASHER / EYEBOLT

Nut washer Eyebolt are designed to meet or exceed major international building codes and Department of Transportation requirements.



BOLTS STUDS

Hexagon-Head bolts, Countersunk head bolts, Allen head bolts, Round Head bolts, Square head bolts, Wheel bolts, Eye bolts, Headless Setscrew screws, T-head bolts, Round head bolts, Heavy-duty bolts, Pre-loading bolts, Bolts without pre-loading, Ribbed iron bolts.



CONCRETE ANCHOR SYSTEM

Our Column Anchor Systems are designed especially for the assembly of machinery, columns or power poles in constructions.



PLASTIC SPACERS ELEMENTS

They are designed not to lose zero-zero connection end of the element embedded in concrete especially in subway and top-down projects.

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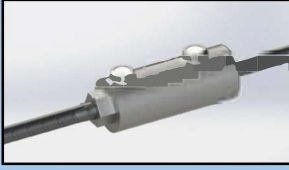
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TME-05

MECHANICAL REBAR COUPLER



Groutcoup Couplers are specifically designed to structurally join precast structural elements such as columns and shearwalls. The sleeve is assembled to the threaded rebar and positioned within the form at the precast plant.

Tapercoup Couplers are designed to splice the same diameter bars where at least one bar can be rotated and moved freely in its axial direction. The couplers are machined to have taper threads inside which create a mechanical connection of two corresponding reinforcing steel.



Doublecoup Couplers are designed to splice the same diameter bars where none of the bars can be rotated and moved freely in its axial direction. Two parts of the coupler are machined to get parallel threads inside which create a mechanical sleeve between corresponding reinforcing steels.

Friccoup Couplers are designed to splice the same diameter bars where at least one bar can be rotated and moved freely in its axial direction.



Headcoup Anchorage is designed to create a sufficient hook in concrete based on shear cone theory. It offers an alternative way to create a simpler and more efficient anchorage of the rebar end than the traditional hooked rebar in the concrete.

BridgeCoup splices are widely used in cages manufacturing. When the bars cannot be brought butt to butt (as it happens often in cages manufacturing), BridgeCoup Caging splices can be used. Both bars are threaded with a standard upset parallel thread, and a BridgeCoup Set is used to connect them.



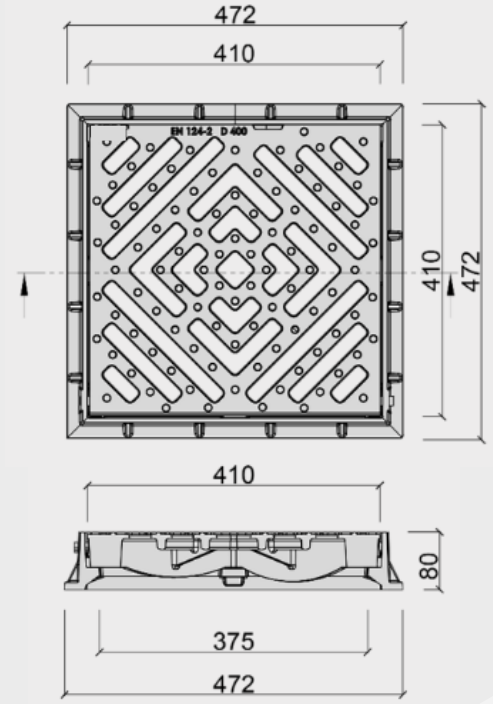
Rollcoup is a rolled parallel threaded mechanical splicing system designed for the connection of concrete reinforcing bars. Rollcoup is designed to splice the same diameter bars where at least one bar can be rotated and moved freely in its axial direction.

Cryocoup Couplers are designed to splice the same diameter bars where at least one bar can be rotated and moved freely in its axial direction. Cryocoup couplers should be specified whenever cryogenic-grade reinforcing bar is used, or during normal operating or emergency conditions where the temperature falls below $-20\text{ }^{\circ}\text{C}$ ($-4\text{ }^{\circ}\text{F}$).



YAĞMUR SUYU IZGARASI

GRATING WITH FRAME



D400 : 40 Ton Taşıma Kapasitesi
Dış Ölçüler : 472 x 472 x 80 mm
Malzeme : GGG 50
Boya ve Renk : Bitümlü Boya
Ağırlık : 35 kg \mp 3 kg

 **Yük Sınıfı D400**

D400 : 40 Ton Loading Capacity
Outside Dim. : 472 x 472 x 80 mm
Matelial : GGG 50
Paint & Color : Bituminous Paint
Weight : 35 kg \mp 3 kg

Sertifikalar :

ISO 9001 : 2015 ISO 10002 : 2018
ISO 14001 : 2015 ISO 45001 : 2018



* Opsiyonel Üretim Ağırlıkları : 27 kg, 44 kg, 50 kg
* Optional Production Weights : 27 kg, 44 kg, 50 kg



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YAĞMUR SUYU IZGARASI

GRATING WITH FRAME

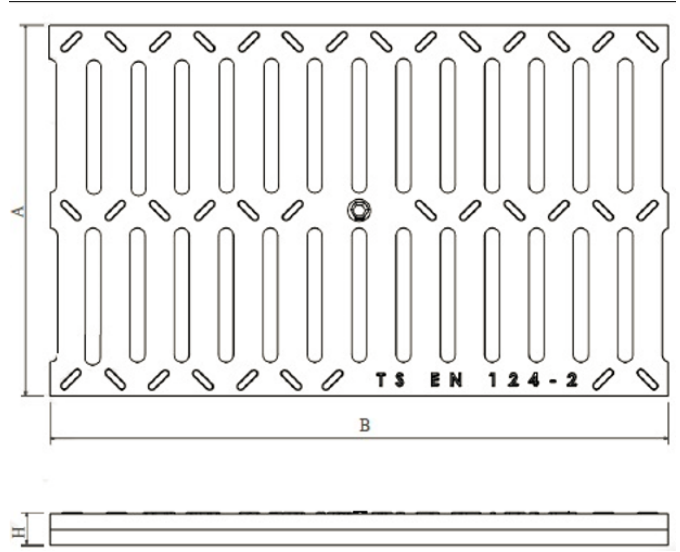
D400 : 40 Ton Taşıma Kapasitesi

Dış Ölçüler : 500 x 500 x 45 mm

Malzeme : GGG 50

Boya ve Renk : Bitümlü Boya

Ağırlık : 27 kg \mp 3 kg



 Yük Sınıfı D400

D400 : 40 Ton Loading Capacity

Outside Dim. : 500 x 500 x 45 mm

Material : GGG 50

Paint & Color : Bituminous Paint

Weight : 27 kg \mp 3 kg



Sertifikalar :

ISO 9001 : 2015

ISO 10002 : 2018

ISO 14001 : 2015

ISO 45001 : 2018

A : 500 mm

B : 500 mm

H : 45 mm

* Opsiyonel Üretim Ağırlıkları : 22 kg, 35 kg, 44 kg

* Optional Production Weights : 22 kg, 35 kg, 44 kg



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UPVC PIPES & FITTINGS

UPVC is an excellent choice for piping. It is resistant to corrosion, chemical damage, and weathering. It is made from PVC resin with other chemical.

UPVC pipes are available in a variety of sizes

Water supply lines / sewer lines

Drainage systems / irrigation systems

electrical conduit / Special Purpose Pipes

FITTINGS

- Elbow
- Tee
- Cross
- Cuff
- Gland
- Yellow Gland
- Nipple
- Reduction



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TUNNEL VENTILATION



Axial Fans



Jet Fans

AXIAL FANS

Depending on the design of the tunnel ventilation system, axial fans are usually used to blow clean air into the tunnel while exhausting the stale air and smoke in the event of a tunnel fire.

Axial fans can be of the single-way type or fully reversible type.

Depending on the site installation conditions, the fans can be manufactured in either a horizontal or vertical configuration.

TME GRUP has experience in vertical and horizontal fans supplied in recent tunnel projects worldwide.

JET FANS

Among the different tunnel ventilation systems, jet fan longitudinal ventilation is the most widely used. Jet fans can be of the single-way type or the double-way type.

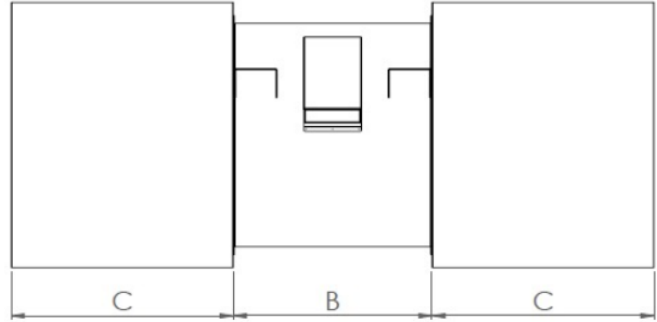
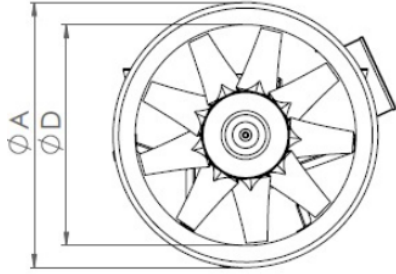
Jet fans are suspended from the tunnel ceiling or tunnel walls by means of a suspension system and are mounted on the base chassis and mounted inside the tunnel. In most projects, the suspension system and chassis are within the scope of TME GRUP.

Tunnel Ventilation Systems

In highway tunnels, ventilation systems are utilized to address air pollution caused by vehicle exhaust emissions and heat generation. The combination of exhaust fumes and heat creates air pollution that can adversely affect passengers' health. Tunnel Ventilation Systems are among the critical safety measures implemented during tunnel construction. These systems were developed in the 20th century to mitigate the effects of exhaust gases. Pollution levels can be controlled to limit the number of vehicles using the tunnel and improve vehicle engine performance.

Highway Tunnel Requirements

Except for very short tunnels, ventilation is essential in highway tunnels, particularly during periods of heavy traffic. In a tunnel where traffic flows in one direction and moves freely, natural airflow can suffice for tunnels up to 1–2 kilometers in length. However, for longer tunnels or in cases where traffic is slow-moving or stationary, ventilation becomes a necessity.



Types of Pollution in Tunnels

Pollution inside tunnels primarily results from exhaust gases, including:

- **Carbon Monoxide:** The primary pollutant produced by gasoline engine exhaust. Even minimal concentrations can pose a fatal risk.
- **Nitrogen Oxides:** Produced by both gasoline and diesel engines, nitrogen oxides (NO and NO₂) are less toxic than carbon monoxide.
- **Sulfur Dioxide:** Known to irritate the nasal and bronchial passages. While undesirable at concentrations between 5–10 ppm, it is emitted in negligible amounts by motor vehicles and typically does not pose a ventilation challenge in tunnels.

Tunnel Ventilation Systems

Air distribution systems in tunnels are generally categorized into longitudinal, transverse, and semi-transverse types. The simplest is the **longitudinal ventilation system**, where air enters at one end of the tunnel and exits at the other. The airflow is driven by wind, pressure differences, vehicle movement in single-direction tunnels, or a fan system.

Transverse ventilation systems operate independently of longitudinal airflow and use two separate channels to supply and extract air along the tunnel length, facilitated by fans.



Longitudinal Ventilation Systems

In very short tunnels, particularly in mountainous areas with sparse traffic and natural airflow, ventilation occurs naturally without additional systems.

Transverse Ventilation Systems

For long tunnels, a fully transverse ventilation system is ideal for central sections, provided that installation and operational costs are not prohibitive. Air is supplied through a channel and extracted at road level. This process can also be reversed, depending on specific requirements.

	A	B	C	D
560	760	420	560	560
630	830	470	630	630
710	910	500	710	710
800	1000	580	800	800
900	1100	700	900	900
1000	1200	775	1000	1000
1120	1320	775	1120	1120
1250	1450	775	1250	1250
1400	1600	850	1400	1400
1600	1800	900	1600	1600

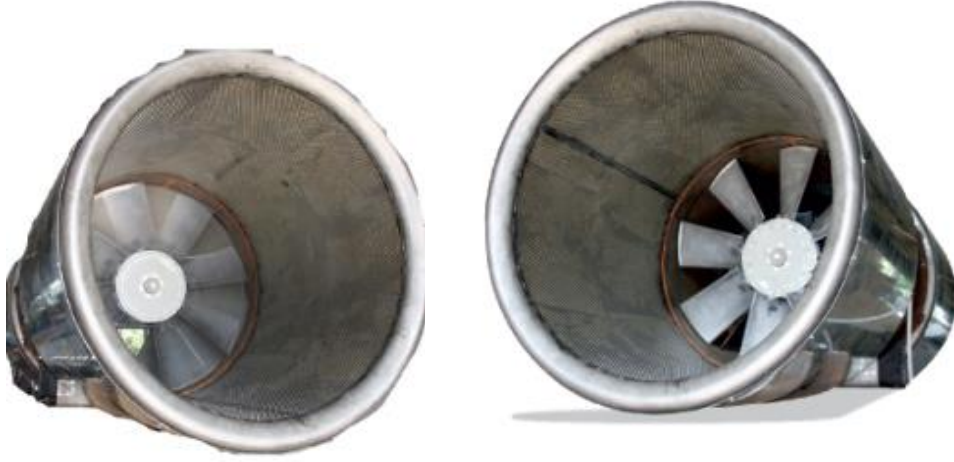
Çap (mm)	Uzunluk [mm]	Dış Çap [A]	İtme Kuvveti [N]	Debi [m ³ /s]	Çıkış Hızı [m/s]	Güç [kW]	Kutup
560	1540	760	225	6,8	27,6	7,5	2
			305	7,9	32,1	11	
630	1730	830	399	10,2	32,7	15	2
			443	10,7	34,4	18,5	
710	1920	910	518	13,1	33,0	22	2
			670	14,9	37,6	30	
800	2180	1000	296	11,1	22,2	7,5	4
			354	12,2	24,2	11	
900	2500	1100	525	16,7	26,2	15	4
			605	17,9	28,2	18,5	
1000	2775	1200	749	22,1	28,2	22	4
			950	24,9	31,7	30	
1120	3015	1320	1275	32,4	32,8	37	4
			1395	33,8	34,4	45	
1250	3275	1450	1450	38,5	31,4	45	4
			1715	41,9	34,1	55	
			2035	45,6	37,2	75	
1400	3650	1600	1648	46,0	29,9	45	6
			1802	48,1	31,2	55	
1600	4100	1800	1748	54,1	26,9	45	6
			2075	59,0	29,3	55	

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Features

Capacity:

- Fan diameters between \varnothing 630 mm - \varnothing 1600 mm
- Flow ranges from 6000 m/h to 200,000 m/h
- Temperature resistance degrees °C: Suitable for F300 (2 hours) - F400 (2 hours)

Application Areas and Features:

- Provides fast and efficient smoke evacuation in tunnels.
- Adjustable aluminum wings Double-sided wing structure
- BSRIA certified
- Single or double-speed motor Easy installation



TUNNEL LIGHTING AND ELECTRICITY



Tunnel Lighting: A Highly Technical and Critical Application

Tunnel lighting is arguably the most technical and critical application among all lighting solutions. Due to the inherent risks of road traffic and the constraints imposed by a completely enclosed and isolated environment, successfully illuminating a tunnel's surface is an extremely challenging task. It is not sufficient to merely light different zones within a tunnel uniquely; seamless transitions between these zones are equally essential.

Although there are strictly defined rules regarding glare and illumination levels, meeting these requirements is only possible by combining precise design with the right product. With decades of experience and over a hundred completed projects, TME GRUP's expertise and capabilities in tunnel lighting are unparalleled.



TME GRUP, driven by a dedicated team, is the one-stop solution for executing a successful tunnel lighting project, contributing to solving the complex transportation needs of modern cities. Each tunnel project is approached uniquely, starting with meticulous design and continuing with the integration of the right products.

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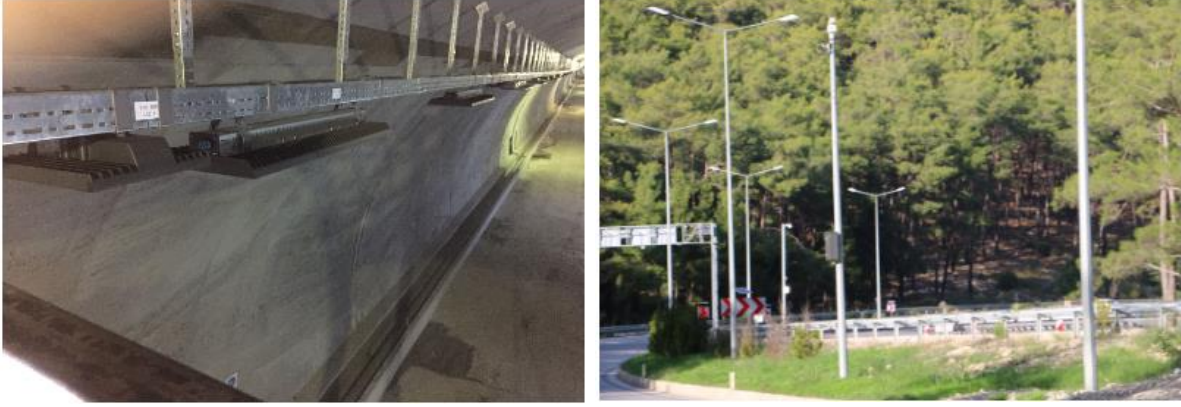
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The versatility of TME GRUP's product capabilities allows for fine-tuning of optics to ensure accurate lighting across various tunnel zones. The careful selection of materials and components ensures the durability of products under harsh environmental conditions. The integration of state-of-the-art, energy-efficient control systems adds the finishing touch to each project.



Increasing Need for Tunnel and Underpass Lighting

With expanding transportation networks and growing traffic density, the number of tunnels and underground passages is steadily increasing. Tunnels are often preferred as transportation links to shield cities from the visible effects of traffic or to preserve the natural environment without deformation.

Due to their enclosed structure, tunnels impose significant constraints on maintenance access to any point within them. Furthermore, tunnels are subject to highly damaging atmospheric conditions. Therefore, the lighting systems used in these areas must be highly reliable and, ideally, maintenance-free. At this critical juncture, tunnel LED lighting systems provide the most robust solution to meet these needs.



Objectives of Tunnel Lighting

The goal of tunnel lighting is to ensure safe and comfortable traffic flow during both day and night at a brightness level that is no less than what exists in the surrounding areas outside the tunnel.

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This applies to traffic moving at the "Tunnel Lighting Design Speed" as it approaches, passes through, and exits the tunnel. While tunnels inherently impose speed limitations, the primary aim is to maintain uninterrupted traffic flow, regardless of speed.

Importance of Adaptation to Lighting Conditions

This requirement is particularly critical during daytime when the human visual system must adapt from bright to dark environments. A poorly or inadequately lit tunnel entrance can create a "black hole effect" in the driver's field of vision. This effect triggers an instinctive reflex to suddenly reduce speed, potentially leading to severe accidents.