FRP MANUAL

MOLDED GRATINGS
PULTRUDED PROFILES
PULTRUDED GRATINGS
LADDERS & RAILINGS
FABRICATION / ASSEMBLY
ACCESSORIES

lichtgitter

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A BRIGHT OUTLOOK SINCE 1929

LICHTGITTER WAS ESTABLISHED IN GERMANY IN 1929 IN ORDER TO CARRY OUT THE SPEZIALIZED MANUFACTURING OF GRATINGS AND STEEL PRODUCTS.

By the continuous monitoring of our performance, and quality systems, together with innovation in manufacturing techniques, we have ensured Lichtgitter's place in the forefront of manufacturers of industrial floor coverings with subsidiaries all over the world.

Since the early 90`s Lichtgitter has expanded their product range to include fiber-reinforced plastic (FRP) products in addition to metal gratings. The versatility of FRP products in nearly all areas of business makes this development interesting.

The sky is the limit for the use of FRP materials in construction - whether for substructures, handrail systems, vertical ladders or complete platforms.

FOUNDED
1929

EMPLOYEES NATIONAL
200

31
SUBSIDIARIES

1.600
GROUP MEMBERS WORLDWIDE

COUNTRIES
21

THE LICHTGITTER GROUP

To meet the demands of our international customers and to put into effect the integration of the European and non-European grating markets, Lichtgitter has established subsidiaries and partners, not only throughout Europe, but also worldwide. This has formed the basis for the creation of a global network for both distribution and production outlets.

Decades of experience in manufacturing of gratings are not always sufficient in itself. Only fully verified standards and properly followed instructions, along with further innovative development of production procedures and materials, can satisfy our client's demands and expectations, in respect of quality.

LICHTGITTER SERVICE

OUR COMPREHENSIVE SERVICES HELP TO ACHIEVE YOUR GOALS QUICKLY. FROM THE VERY FIRST CONSULTATION, WE OFFER YOU COMPETENT, PRODUCT AND OBJECT-RELATED ADVICE WITH PROFESSIONAL AND TECHNICAL KNOW-HOW.

In this way, our specialists can develop innovative solutions to meet your specific requirements. We are happy to assist you with your project from the planning stage through to the preparation of installation plans and complete technical documentation. Packing lists, safe packing and commissioning are also part of our service.

- Technical advice on the calculation and selection of our different products
- Preparation of auditable static verification
- Production of 2D- and 3D drawings
- Preparation of installation plans
- Providing of tender documents
- Measurement on-site
- Appropriate packaging and consignment
- Assembly for testing reasons and trainings

THE LICHTGITTER GROUP

OUR MISSION IS AS SIMPLE AS IT IS CHALLENGING: TO PROVIDE OUR CUSTOMERS WITH INNOVATIVE PRODUCTS THAT MEET THE HIGHEST QUALITY STANDARDS. THIS IS WHAT OUR CUSTOMERS HAVE APPRECIATED FOR MANY YEARS.

In addition to pressure locked and forge welded gratings, our range includes perforated metal planks, FRP products and spiral staircases in a wide variety of designs. Tailored to your needs.

LICHTGITTER IN THE USA

LOCATION **1**:

Lichtgitter USA, Inc.
12818 North Lake Houston Parkway
77044 Houston / TEXAS

LOCATION **2**:

Lichtgitter USA, Inc.
1301 Renaud Dr.
70583 Scott / LOUISIANA

SUBSIDIARIES AND PARTNERS WORLDWIDE

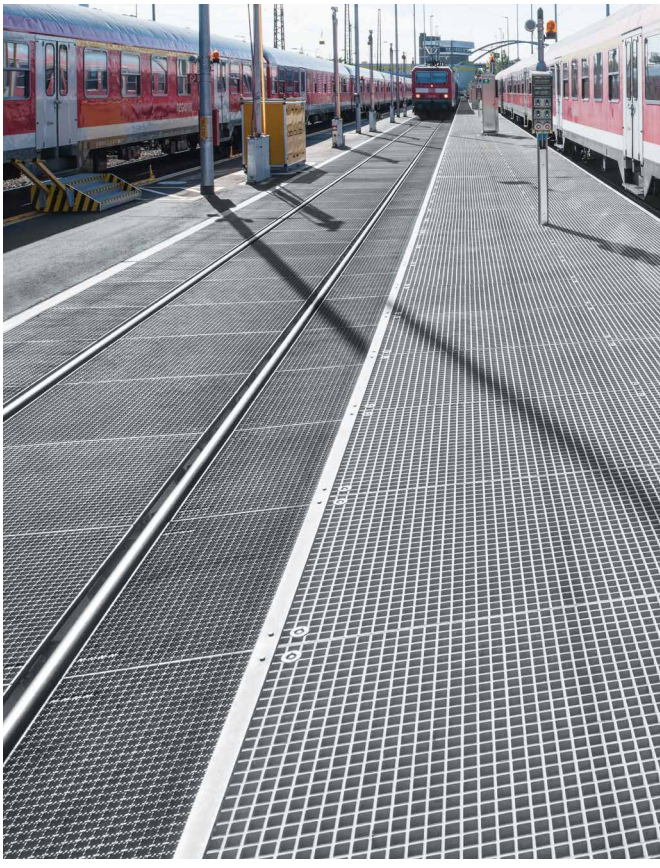
Austria
Belgium
Bulgaria
Czech Republic
Denmark
Finland
France
Germany
Great Britain
Greece
Italy
Netherlands
Norway
Qatar
Romania
Slovakia
Spain
Sweden
Switzerland
Turkey
United States

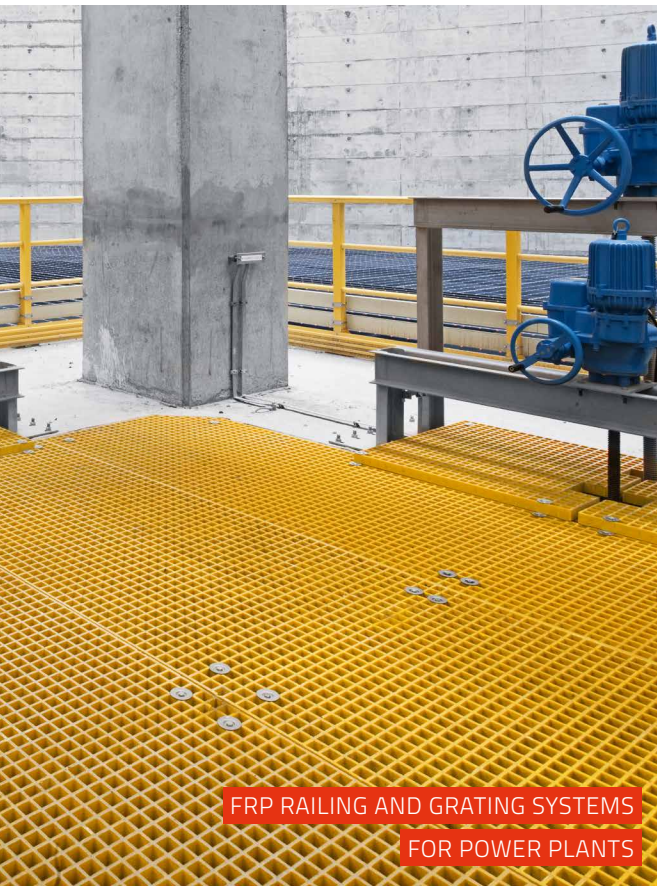
FRP AT LICHTGITTER

The positive experience in the use of FRP products has made us well aware that FRP material holds distinct advantages in a variety of applications. In addition to our established range of FRP flooring designs, we have also added FRP construction profiles and related application possibilities to our catalog. Our unique range of services, support our customers from the earliest stages of development to the final installation of the project.

FRP PLATFORM SYSTEM WITH RAILINGS

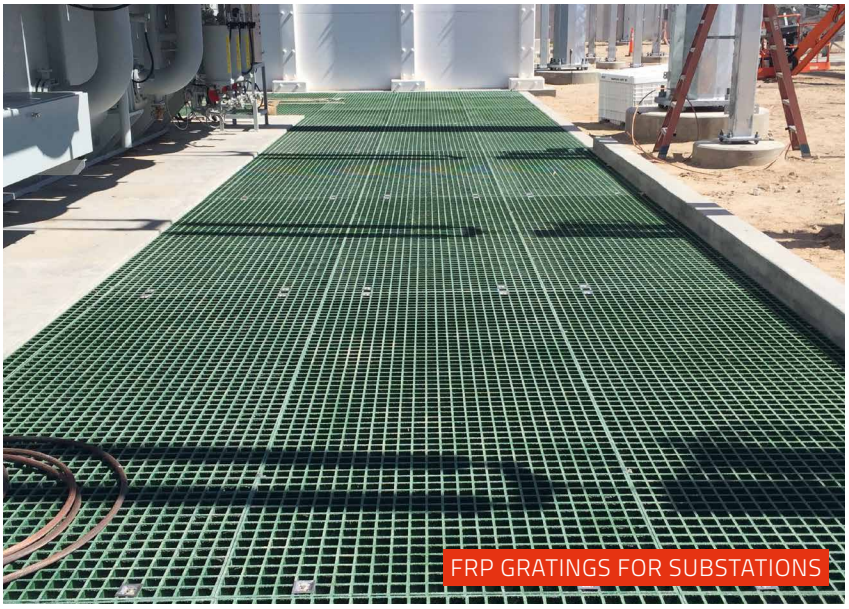
FRP GRATINGS FOR WASTE WATER PLANTS





FRP RAILING AND GRATING SYSTEMS FOR POWER PLANTS

DOOR SYSTEMS

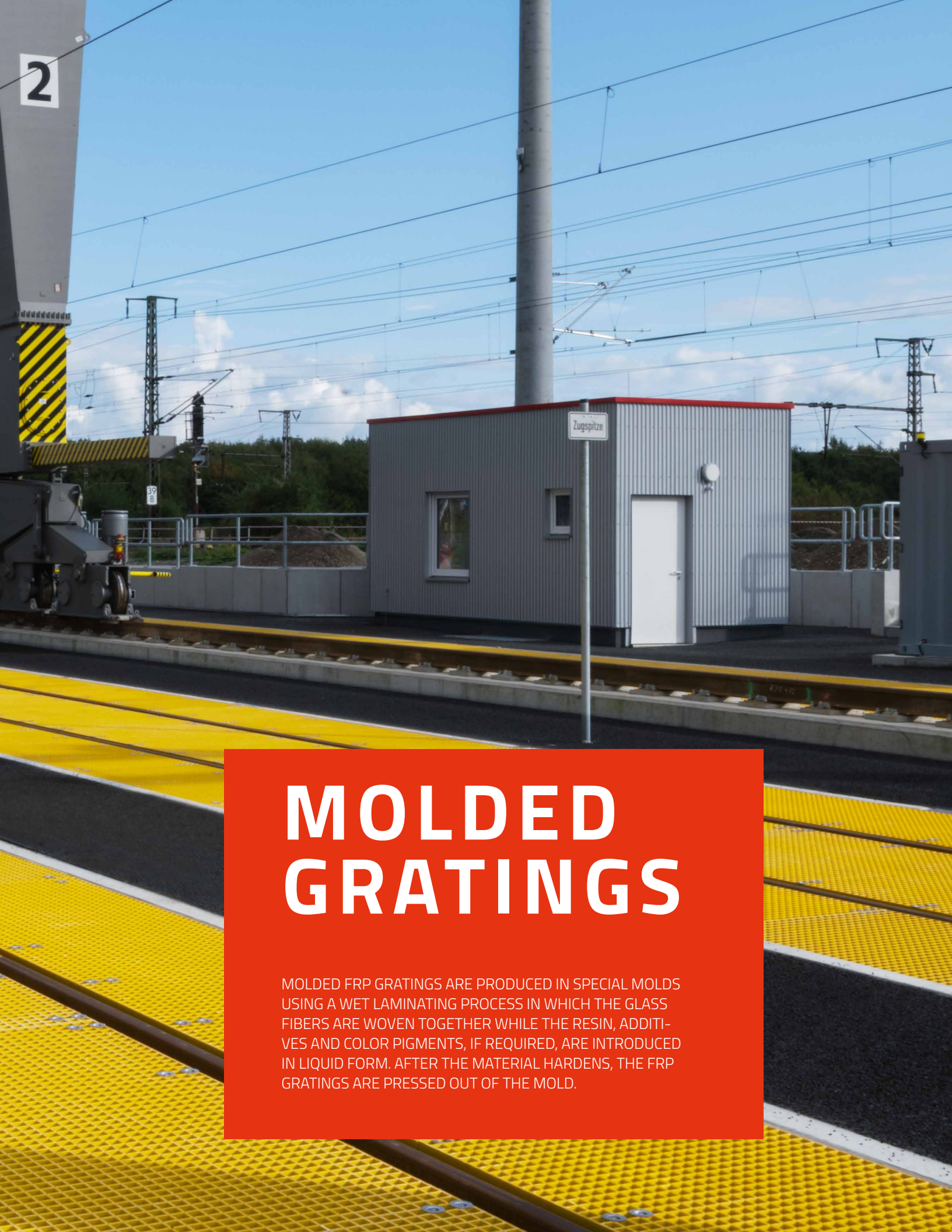


FRP GRATINGS FOR SUBSTATIONS

FRP FOR RAILWAY APPLICATIONS

FRP JETTIES


Zugspitze



MOLDED GRATINGS

MOLDED FRP GRATINGS ARE PRODUCED IN SPECIAL MOLDS USING A WET LAMINATING PROCESS IN WHICH THE GLASS FIBERS ARE WOVEN TOGETHER WHILE THE RESIN, ADDITIVES AND COLOR PIGMENTS, IF REQUIRED, ARE INTRODUCED IN LIQUID FORM. AFTER THE MATERIAL HARDENS, THE FRP GRATINGS ARE PRESSED OUT OF THE MOLD.

CHARACTERISTICS

Advantages of Molded FRP (Fiber Reinforced Plastic) gratings include a myriad of beneficial characteristics.

CHEMICAL RESISTANCE

In terms of chemical resistance, they offer high resistance to weathering, corrosion and various chemicals, making them suitable for various environments.

ANTI-SKID

The meniscus and integral grit surfaces of molded products provide unsurpassed slip resistance for improved worker safety. The anti-skid surface produces an optimal steadfastness of R13 according to DIN 51130.

LIFESPAN

In addition to the ease of installation and maintenance, the grating will not corrode or rot in any way, as is common with established materials such as wood or steel. Combined with this advantage, the grating can achieve a much longer lifespan.

HIGH STRENGTH TO WEIGHT RATIO

Less than one-half the weight of steel grating, allowing easy removal for access below floor level and installation without heavy equipment and less manpower.

ELECTRICALLY & THERMALLY NON CONDUCTIVE

Fiberglass is electrically non-conductive for safety and has low thermal conductivity, resulting in a more comfortable product when physical contact occurs.

APPEARANCE

Their appearance can be customized to fit different shapes, with pigmentation available in a range of RAL colors.

ERGONOMICS

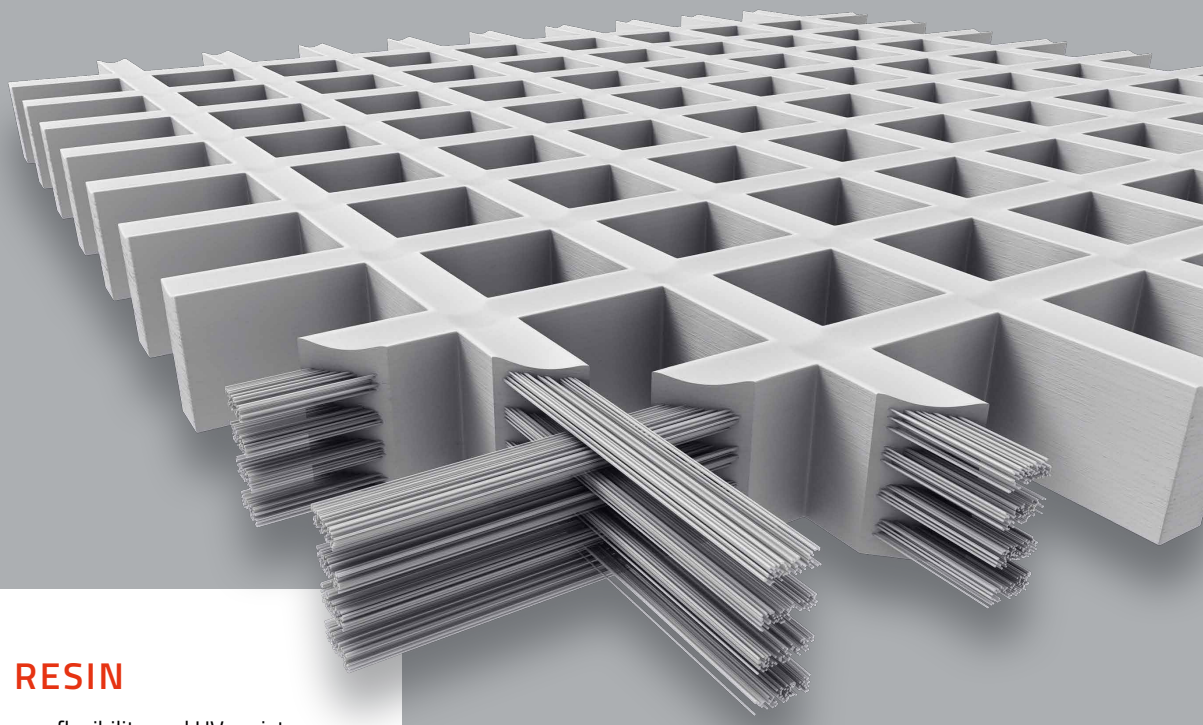
From an ergonomic standpoint, Lichtgitter FRP gratings provide comfort for walking and standing, as well as shock absorption and sound attenuation properties.

LOGISTICS

Logistically, they offer advantages such as low transportation costs, short delivery times and easy storage.

FRP COMPONENTS

Resin, glass fibers, additives and pigment are the basic components of the FRP compound material, which can be used in a variety of different areas on account of its shape and ease of use.



RESIN

The chemical resistance, flexibility and UV resistance of the FRP product is determined by the resin used. A range of resins are available for use, depending on the intended purpose.

FRP products can be made from orthophthalic resin, isophthalic resin and vinyl ester resin (for extremely heavy chemical contamination); Lichtgitter uses isophthalic resin as standard. The distinguishing characteristic of phenolic resin is its flame resistance and very low smoke emission levels.

ADDITIVES

Additives such as hardeners, catalysts and UV stabilizers are other components of the material.

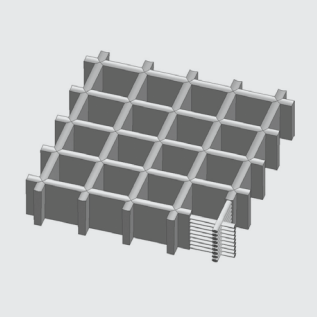
GLASS FIBERS

Multi-layered continuous glass fibers are used to reinforce the material.

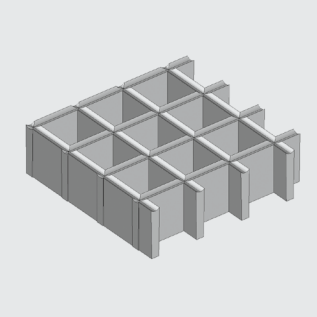
PIGMENTS

Lichtgitter FRP gratings are grey as standard, similar to RAL 7035. Color pigments make it possible to give the FRP products a particular color, providing a range of architectural design possibilities.

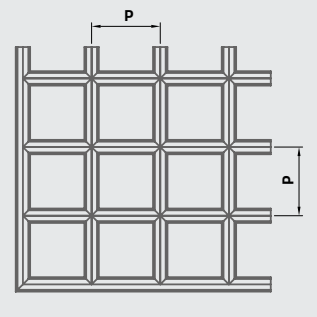
TECHNICAL TERMS



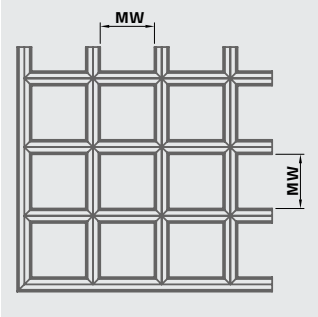
Supporting rods/crossbars
Molded FRP gratings are constructed with supporting rods and crossbars of the same height. Only close-meshed FRP gratings have a different main mesh structure to the basic mesh structure.



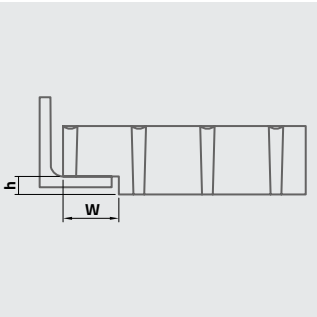
Open edges
FRP gratings whose external dimensions deviate from production dimensions might not have closed edges. Open edges are not included. The cut edges should be permanently sealed.



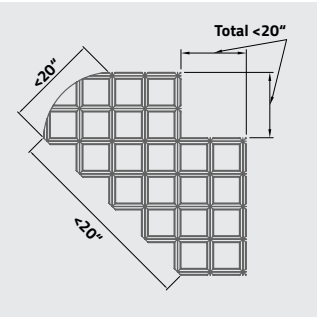
Mesh spacing
The distance from one axis to the other axis of supporting rods/crossbars.



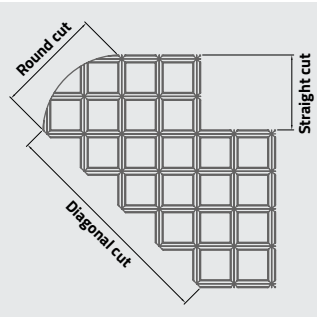
Mesh width
The clearance between supporting rods/crossbars.



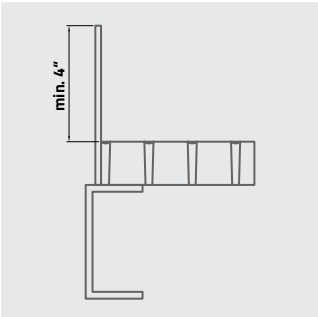
Recess areas
Recess areas are necessary in the contact area to be on the same level as the adjacent floor covering. Individual structural analysis should be carried out.



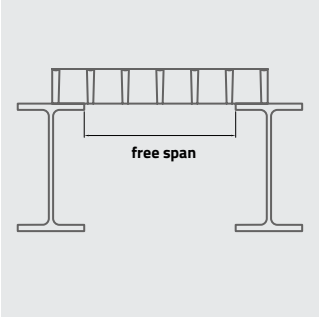
Cut-outs
Cut-outs are straight, diagonal and round cuts which deviate from the smallest possible surrounding rectangle or square. In contrast to steel gratings, these are not re-incorporated in accordance with DIN 24537-3.



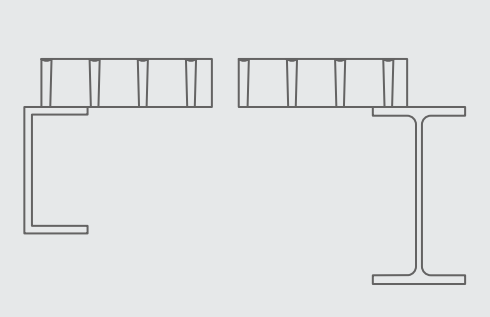
Small cuts
Small cuts are straight, diagonal and round cuts which are smaller than 2 ft. These are calculated as allowances.



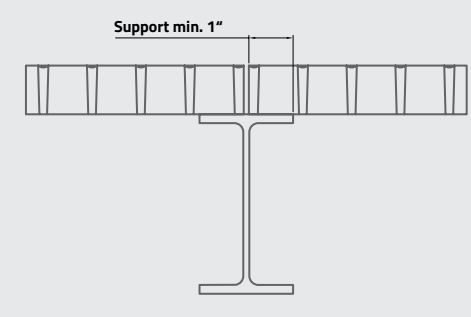
Toe plate
Flat material screwed onto the grating after construction which protrudes from the grating edge. It must be at least 4" higher than the grating surface.



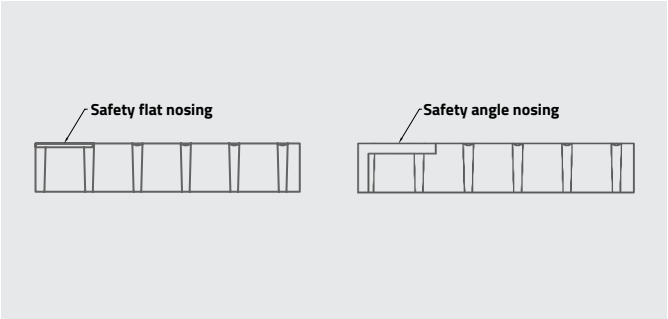
Span
The span is the clearance between two supports.



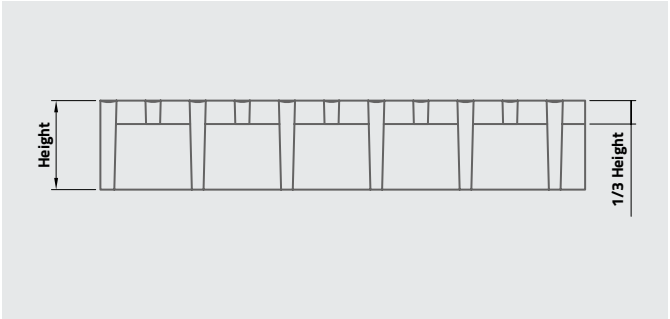
Substructure
A substructure is a structural component which a grating can be laid on.



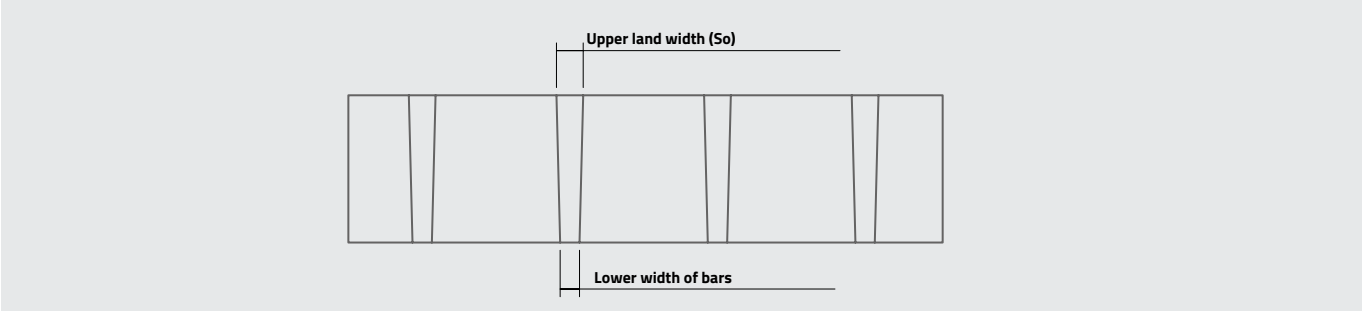
Support
The planned length of each support must be at least 1”. Deviations are permitted if structural measures are taken to ensure that the grating will not move in the direction of the support.



Black sanded solid nosing / nosing angle
We supply a solid black sanded toe plate in the entrance area to ensure that our stairtread gratings and platforms comply with DIN 24531-3. These can be constructed in the form of flat material or an angle depending upon structural requirements.



Micro mesh
The upper third of the mesh structure deviates from the basic mesh structure.



Land width
To press the FRP gratings out of the molds, the support rods/crossbars are conically tapered. This leads to the Upper land width (So) being larger than the Lower land width (Su), measuring between 0.196” and 0.295” for a standard grating.

QUALITY STANDARDS

In order to ensure the consistency of the reliable high quality of our portfolio, all relevant standards for FRP products and associated services are to be strictly adhered to. Beyond that Lichtgitter played an influential role in drawing some German Standards like DIN 24531-3 and DIN 24537-3, which is a technical standard that pertains to gratings made of FRP used as stairtreads or as floor coverings. Further certificates relate to anti-slip resistance, flammability classification or verifiable structural analysis.

We are convinced, that only standards and regulations which are consistently adhered to and verified as well as innovative new and advanced developments of production processes and materials can meet our quality requirements and those of our customers.

THE RESULTS

- High quality products
- Problem-solving know-how
- Handling major projects from the bidding phase through to installation
- Handling architecturally ambitious projects
- Our own testing facilities used for structural validation
- On-going quality control

The values given in the following table should be considered as mean values.

Mechanical properties	Standard	Imperial		Metric	
		Value	Unit	Value	Unit
bending strength	DIN EN ISO 14125	40.610,00	psi	280,00	Mpa
shear modulus	DIN EN ISO 14130	3.626,00	psi	25,00	Mpa
modulus of elasticity, E	DIN EN ISO 14125	2,10	10(6) psi	14,50	Gpa

DNV CERTIFICATION

Lichtgitter's molded gratings are certified by DNV, the world's leading classification society and recognized advisor to the maritime industry. The type approval certificate is required in many maritime applications and in the shipbuilding industry.

DNV

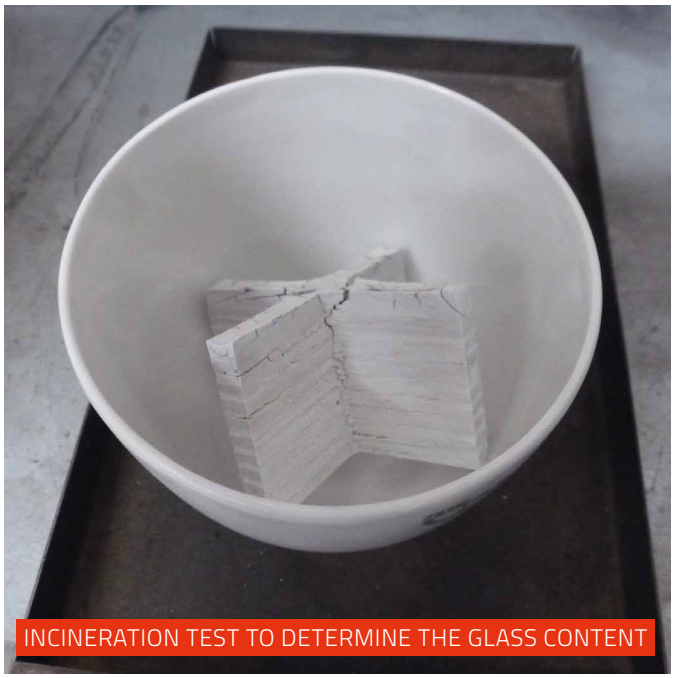
PRODUCTION AND QUALITY CONTROL

At Lichtgitter we offer comprehensive services surrounding FRP gratings to ensure quality and reliability every step of the way. Our commitment to excellence extends from production to quality control, ensuring that your FRP gratings meet the highest standards.

Quality Control: We meticulously check FRP materials for specific properties, ensuring they meet the required standards for strength, durability, and safety. Our rigorous quality control measures guarantee the reliability of every FRP grating we supply.

Testing: From load tests to flame resistance assessments, we conduct thorough testing to verify the performance and safety of our FRP gratings. Our commitment to quality assurance means you can trust the durability and resilience of our products in demanding environments.

Comprehensive Support: We offer full support throughout the entire process, from planning and layout drawings to design and technical documentation. Our team is dedicated to ensuring that your FRP grating project is executed seamlessly and efficiently.



INCINERATION TEST TO DETERMINE THE GLASS CONTENT

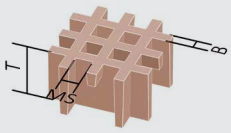
THREE-POINT BENDING TEST TO DETERMINE THE MATERIAL PROPERTIES

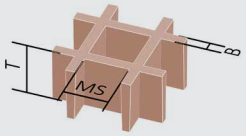
GRATING SIZES

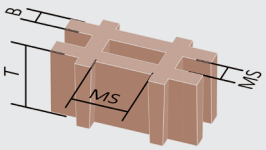
MOLDED STANDARD PANEL TYPES

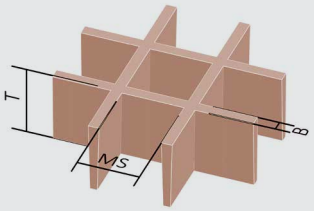
Type	Height	Mesh Size	Bar	Weight	Standard Panle Sizes
SM1505 - Square	1/2"	1-1/2" x 1-1/2"	0.196" to 0.236"	1.16	4' x 8', 4' x 12'
SM2005 - Square	1/2"	2" x 2"	0.196" to 0.236"	1.08	4' x 8', 4' x 12'
SM1510 - Square	1"	1-1/2" x 1-1/2"	0.196" to 0.246"	2.53	3' x 10', 4' x 8', 4' x 12'
MM7510 - Mini Mesh	1"	3/4" x 3/4"	0.196" to 0.246"	3.22	4' x 8', 4' x 12'
RM1410 - Rectangular	1"	1" x 4"	0.196" to 0.246"	2.70	4' x 8', 4' x 12'
SM1513 - Square	1-1/4"	1-1/2" x 1-1/2"	0.196" to 0.256"	2.96	4' x 8', 4' x 12'
SM1515 - Square	1-1/2"	1-1/2" x 1-1/2"	0.196" to 0.271"	3.85	3' x 10', 4' x 8', 4' x 12', 5' x 10'
MM7515 - Mini Mesh	1-1/2"	3/4" x 3/4"	0.196" to 0.271"	4.74	4' x 8', 4' x 12'
RM15415 - Rectangular	1-1/2"	1-1/2" x 4"	0.196" to 0.271"	3.00	4' x 8', 4' x 12'
RM1615 - Rectangular	1-1/2"	1" x 6"	0.196" to 0.271"	4.70	4' x 8', 4' x 12'
HDRM1215 - Rectangular High Load	1-1/2"	1" x 2"	0.354" to 0.433"	6.75	4' x 6', 4' x 8'
SM2020 - Square	2"	2" x 2"	0.196" to 0.295"	4.15	4' x 8', 4' x 12'
MM10020 - Mini Mesh	2"	1" x 1"	0.196" to 0.295"	4.79	4' x 8', 4' x 12'
HDRM1220 - Rectangular High Load	2"	1" x 2"	0.354" to 0.433"	9.62	4' x 6', 4' x 8'
HDSM1525 - Square High Load	2-1/2"	1-1/2" x 1-1/2"	0.354" to 0.433"	9.67	3' x 10', 4' x 8', 4' x 12', 5' x 10'

- Weight may vary acoording to type of resin used and top surface
- Mesh size: Spacing between bar centers
- Other thickness and sizes are available upon request









FLAMMABILITY

ASTM E84, popularly known as the E84 or Tunnel Test, is a standard test method for the surface burning characteristics of building materials. This test method is intended only to provide comparative measurements of surface flame spread and smoke density with those of selected red oak and fiber cement board surfaces under specific fire exposure conditions. Please see below classification table.

All of Lichtgitter´s Vinyl ester or Isophthalic resin products are meeting the requirements of Class A of ASTM E84 – unless stated otherwise.

CLASS	FLAME SPREAD INDEX (FSI)	SMOKE DEVELOPED INDEX (SDI)
A	0-25	0-450
B	26-75	0-450
C	76-200	0-450

ASTM INTERNATIONAL

CHEMICAL RESISTANCE

Lichtgitter FRP gratings are often used in industries which require the gratings to be resistant to corrosive elements. The medium and its concentration, temperature and the duration of exposure have a major influence on the resistance.

NOTE

Our written and verbal advice is correct to the best of our knowledge, but should not be considered a binding warranty, including with respect to any third party intellectual property rights. You should always test the products that we deliver to see whether they are suitable for the processes and purposes which they are intended for. We are unable to monitor the application, use and processing of the products. This is entirely your responsibility.

This list is for molded gratings only. Please contact us if you have any questions regarding the chemical resistance of pultruded products.

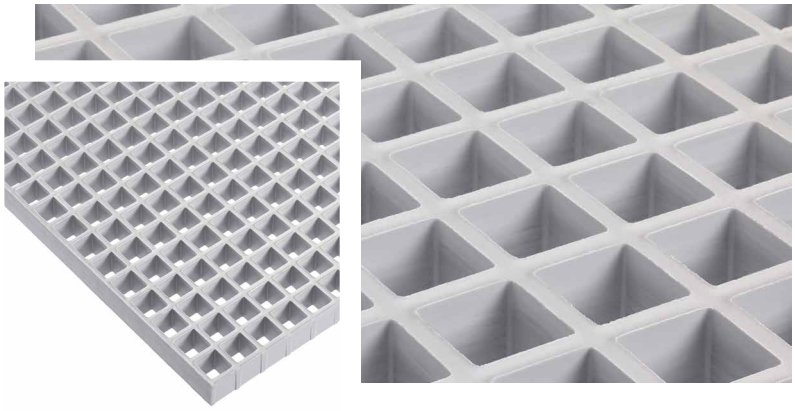
CHEMICAL RESISTANCE TABLE LICHTGITTER GRP GRATINGS (GRP-K/GRP-BK)

Chemical environment	Isophthalic resin % concentration	Isophthalic resin Temp °C	Vinyl ester resin % concentration	Vinyl ester resin Temp °C
Aluminium salts	All	70	All	90
Ammonium bicarbonate	15	50	All	50
Ammonium chloride	All	70	All	85
Ammonium nitrate	All	70	All	85
Acetone	N/R	N/R	100	25
Benzoic acid	All	65	All	90
Benzoin	N/R	N/R	100	60
Prussic acid/hydrocyanic acid	All	65	All	85
Lead acetate / sugar of lead	All	75	All	90
Lead chloride	All	60	All	90
Lead nitrate	All	65	All	90
Hydrobromic acid	50	50	50	50
Calcium salts	All	65	All	90
Calcium hypochlorite	All	65	All	85
Chlorine dioxide	N/R	N/R	All	60
Chlorine water	All	25	All	50
Chromic acid	10	60	10	85
Distilled water	100	75	100	90
Iron salts	100	65	100	85
Vinegar	100	75	100	90
Acetic acid	50	50	50	85
Ethyl acetate, ethyl ether	N/R	N/R	N/R	N/R
Ethyl alcohol/ethanol	50	25	50	30
Ferric salt, iron (III) salt	All	65	All	85
Glycerine	100	65	100	90
Carbamide, urea, carbonyl diamide	All	50	All	60
Heptane	100	40	100	50
Sal volatile/Ammonium carbonate	N/R	N/R	All	65
Lunar caustic/silver nitrate	100	65	100	85
Potash	All	65	All	85
Calcium nitrate	All	85	All	90
Calcium hydroxide	25	65	35	85
Carbon dioxide/Carbolic acid/coal gas	All	50	All	85
Copper cyanide	All	50	All	85
Cuprous salt	All	65	All	85
Magnesium salt	All	65	All	85
Maleic acid	100	65	100	85
Salt water	All	75	All	90
Lactic acid/hydroxypropionic acid	All	75	All	90
Sodium salt	All	25	All	40
Nickel salt	All	75	All	90
Perchloric acid	N/R	N/R	30	30
Phosphoric acid	100	50	100	90
Mercury chloride	100	65	100	85
Ammonium hydroxide	28	N/R	28	38
Mitric acid	20	25	20	40
Hydrochloric acid	37	25	37	35
Sulphuric acid	50	N/R	50	85
Sulphuric acid	25	25	25	90
Sodium hypochlorite	N/R	N/R	10	65
Styrol, styrene, phenylethylene	N/R'	N/R	N/R	N/R
Tetrachloromethane/carbon tetrachloride	100	25	100	60
Trisodium phosphate	N/R	N/R	All	65
Hypochlorous acid	20	30	20	65
Hydrogen peroxide, hydrogen superoxide	10	25	30	50
Tartaric acid	All	75	All	90
Zinc salt	100	65	100	85
Tin chloride	All	70	All	90
Citric acid	All	65	All	85

All = valid for all concentrations
N/R = not recommended

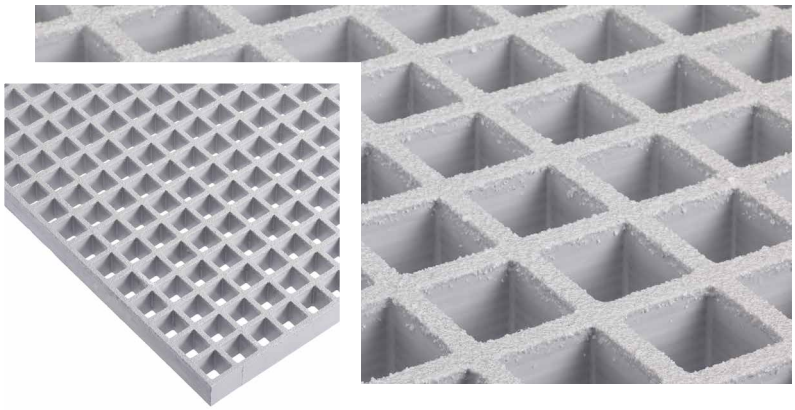
SURFACES

Lichtgitter has a wide range of different grating types and panel dimensions. In addition to the standard panels, many other designs, dimensions and colors can be produced. Standard panels can be cut into individual dimensions. Cutting is carried out on modern CNC machines and panel saws.



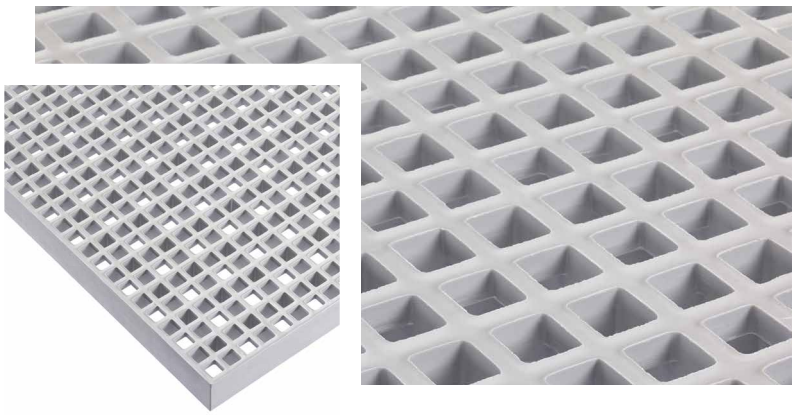
MENISCUS

The concave grating type is origin of the molded gratings. During the heating of the gratings a meniscus surface is formed on the surface of the bars. This results in a very good slip-resistance.



GRIT

The surface of the gritted gratings is subsequently coated with corundum sand or quartz sand. The grit is applied secondary with a resin.

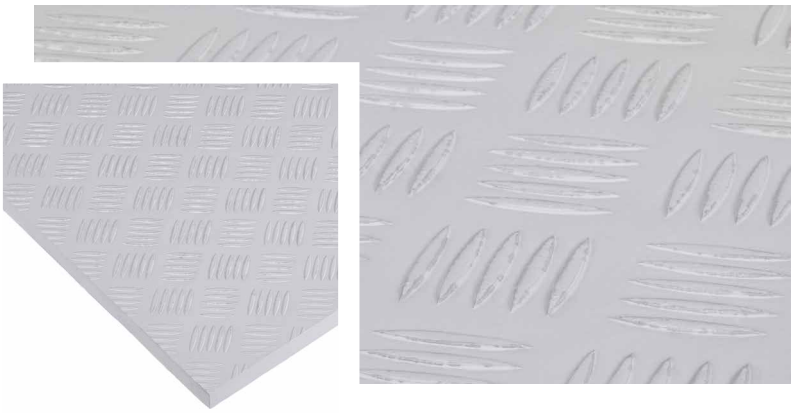


MICRO MESH

The upper third of the mesh structure deviates from the basic mesh structure, creating smaller openings.

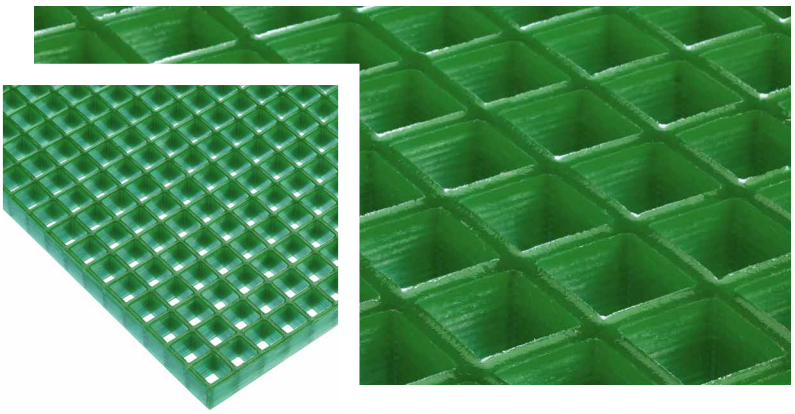
CLOSED

FRP gratings with a closed surface are gratings with a laminated FRP-Plate on top. For this purpose, the concave surface of the grating is grinded away and then the FRP plate is laminated on. The plate is usually 1/8" thick, but can be adjusted according to customer wishes and static requirements.



CHECKERED PLATE

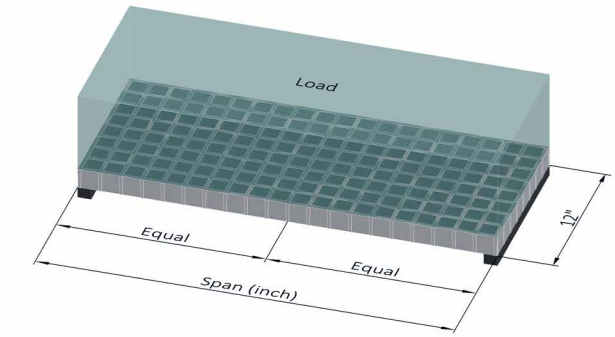
This is another solid FRP grating variant. A checkered plate effect is used instead of a sanded FRP panel.



TRANSLUCENT & TRANSPARENT

Translucent and transparent FRP-gratings are mainly used in the architectural sector. The appearance of the gratings is achieved by the fact that the resin mix does not contain any additives for fire behavior.

UNIFORM LOAD



Notes:

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- The designer should not exceed MAXIMUM RECOMMENDED load at any time. MAXIMUM LOAD represents a 5:1 factor of safety on ULTIMATE CAPACITY. ULTIMATE CAPACITY represents MAX LOAD observed at initial fracture.
- A 50-60 PSF live load is recommended for walkways per ASCE 7. Deflection is typically limited to a ¼" or SPAN divided by 200 under full live load.
- The allowable loads are for static load conditions at standard temperature 73°F +- 3.6°F (23°C +- 2°C).
- For applications involving dynamic loads, long-term loads that result in creep, or elevated temperature, consult Lichtgitter.
- For rectangular mesh grating the load bars need to be oriented in the SPAN direction.
- Grating support shall be >1" (25mm), gratings minimum length shall be >12" (305mm)

LOAD IN LB/SQUARE FOOT (PSF) Deflection in inch

span in inches	typ	60	100	150	200	250	500	1000	2000	maximum recommened load (psf)
12	SM1505	0.03	0.05	0.08	0.11	0.13				378
	SM2005	0.05	0.08	0.12	0.16	0.20				257
	MM7510	<0.01	0.01	0.01	0.01	0.02	0.04	0.07		1591
	SM1510	<0.01	0.01	0.01	0.02	0.02	0.04	0.08		1422
	SM1513	<0.01	<0.01	0.01	0.01	0.01	0.02	0.04		1779
	MM7515	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.04	2391
	SM1515	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.04	2337
	MM10020	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.03	2015
	SM2020	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.03	2220
	LDM1520	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	4000
	HDM1525	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	6182
	RM1410	<0.01	0.01	0.01	0.01	0.01	0.03	0.06	0.11	2009
	RM1215	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.03	3204
	HDRM1220	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	6830
18	SM1505	0.17	0.28	0.42						162
	SM2005	0.24	0.40							112
	MM7510	0.02	0.03	0.05	0.07	0.09	0.17			860
	SM1510	0.02	0.04	0.06	0.08	0.10	0.19			611
	SM1513	0.01	0.02	0.03	0.04	0.06	0.11			895
	MM7515	0.01	0.01	0.01	0.02	0.02	0.05	0.10		1576
	SM1515	0.01	0.01	0.02	0.02	0.03	0.05	0.11		1462
	MM10020	<0.01	0.01	0.01	0.01	0.02	0.03	0.07		1334
	SM2020	<0.01	0.01	0.01	0.01	0.02	0.03	0.07		1497
	LDM1520	<0.01	<0.01	0.01	0.01	0.01	0.02	0.04	0.08	2610
	HDM1525	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.04	4030
	RM1410	0.02	0.03	0.04	0.05	0.06	0.13			887
	RM1215	<0.01	0.01	0.01	0.02	0.02	0.04	0.08	0.16	2047
	HDRM1220	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.05	4616

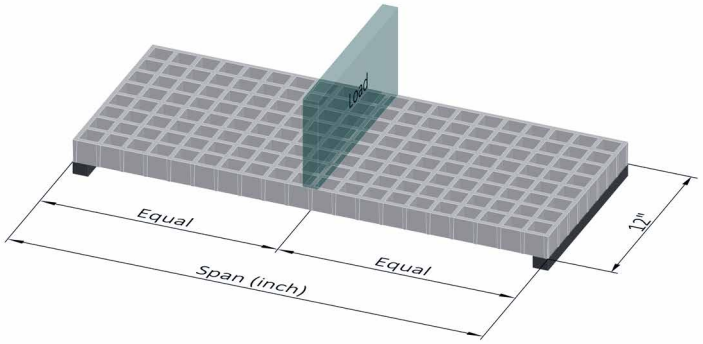
LOAD IN LB/SQUARE FOOT (PSF) Deflection in inch

span in inches	typ	60	100	150	200	250	500	1000	2000	maximum recommened load (psf)
24	SM1505	0.53								90
	SM2005	0.75								64
	MM7510	0.06	0.11	0.16	0.21	0.26				494
	SM1510	0.07	0.12	0.18	0.25	0.31				340
	SM1513	0.04	0.07	0.11	0.14	0.18				497
	MM7515	0.02	0.03	0.04	0.06	0.07	0.15	0.30		1127
	SM1515	0.02	0.03	0.05	0.07	0.08	0.17			815
	MM10020	0.01	0.02	0.03	0.04	0.05	0.10			966
	SM2020	0.01	0.02	0.03	0.04	0.05	0.10	0.20		1040
	LDM1520	0.01	0.01	0.02	0.02	0.03	0.06	0.12		1837
	HDM1525	<0.01	0.01	0.01	0.01	0.01	0.03	0.06	0.11	2986
	RM1410	0.05	0.08	0.13	0.17	0.21	0.42			507
	RM1215	0.01	0.02	0.04	0.05	0.06	0.12	0.24		1159
	HDRM1220	<0.01	0.01	0.01	0.01	0.02	0.03	0.07	0.14	3446
30	SM1505									57
	SM2005									41
	MM7510	0.15	0.25	0.38	0.50	0.63				321
	SM1510	0.18	0.30	0.45	0.60					215
	SM1513	0.10	0.17	0.26	0.34	0.43				315
	MM7515	0.04	0.07	0.11	0.14	0.18	0.35			735
	SM1515	0.05	0.08	0.12	0.16	0.21	0.41			518
	MM10020	0.03	0.04	0.07	0.09	0.11	0.22			749
	SM2020	0.03	0.05	0.07	0.10	0.12	0.24			664
	LDM1520	0.02	0.03	0.04	0.06	0.07	0.14	0.28		1167
	HDM1525	0.01	0.01	0.02	0.03	0.03	0.07	0.14	0.27	2224
	RM1410	0.12	0.21	0.31	0.42	0.52				309
	RM1215	0.03	0.06	0.09	0.11	0.14	0.29			744
	HDRM1220	0.01	0.02	0.02	0.03	0.04	0.08	0.16	0.33	2214
36	SM1505									39
	SM2005									28
	MM7510	0.31	0.51	0.77	1.02					225
	SM1510	0.37	0.62							148
	SM1513	0.21	0.35	0.53	0.71					217
	MM7515	0.09	0.14	0.22	0.29	0.36	0.72			517
	SM1515	0.10	0.17	0.25	0.34	0.42				357
	MM10020	0.05	0.09	0.14	0.18	0.23	0.45			605
	SM2020	0.06	0.10	0.15	0.20	0.25				463
	LDM1520	0.03	0.06	0.09	0.12	0.14	0.29			804
	HDM1525	0.02	0.03	0.04	0.06	0.07	0.14	0.28		1535
	RM1410	0.25	0.43	0.64	0.85					221
	RM1215	0.07	0.12	0.18	0.29	0.59				520
	HDRM1220	0.02	0.03	0.05	0.07	0.08	0.17	0.33		1546
42	SM1505									29
	SM2005									21
	MM7510	0.56	0.93	1.40						167
	SM1510	0.69	1.15							108
	SM1513	0.39	0.65	0.98						158
	MM7515	0.16	0.26	0.39	0.52	0.66				384
	SM1515	0.19	0.31	0.47	0.63	0.77				261
	MM10020	0.10	0.16	0.24	0.33	0.41				467
	SM2020	0.11	0.18	0.27	0.37	0.46				340
	LDM1520	0.06	0.09	0.16	0.21	0.27	0.53			591
	HDM1525	0.03	0.05	0.08	0.10	0.13	0.26	0.51		1127
	RM1410	0.47	0.78	1.17						160
	RM1215	0.13	0.22	0.32	0.43	0.54				382
	HDRM1220	0.04	0.06	0.09	0.12	0.15	0.30	0.61		1138

LOAD IN LB/SQUARE FOOT (PSF) Deflection in inch

span in inches	typ	60	100	150	200	250	500	1000	2000	maximum recommened load (psf)
48	SM1505									22
	SM2005									16
	MM7510	0.94	1.58							129
	SM1510	1.18								83
	SM1513	0.67	1.11							121
	MM7515	0.26	0.44	0.66	0.88	1.10				296
	SM1515	0.32	0.53	0.80	1.07					200
	MM10020	0.16	0.27	0.41	0.55	0.68				361
	SM2020	0.18	0.31	0.46	0.62	0.77				261
	LDM1520	0.11	0.18	0.27	0.36	0.45				451
	HDM1525	0.05	0.09	0.13	0.17	0.22	0.43			860
	RM1410	0.80	1.33							125
	RM1215	0.22	0.37	0.55	0.73	0.91				292
	HDRM1220	0.06	0.10	0.15	0.21	0.26	0.51			867
54	SM1505									17
	SM2005									12
	MM7510	1.50	2.50							102
	SM1510	1.88								65
	SM1513	1.07								96
	MM7515	0.42	0.70	1.05	1.40					233
	SM1515	0.51	0.85	1.28						156
	MM10020	0.26	0.43	0.64	0.86	1.07				288
	SM2020	0.30	0.49	0.74	0.99					206
	LDM1520	0.17	0.29	0.43	0.58	0.72				355
	HDM1525	0.08	0.14	0.21	0.28	0.35	0.69			678
	RM1410	1.29								96
	RM1215	0.35	0.58	0.88	1.17					232
	HDRM1220	0.10	0.16	0.25	0.33	0.41	0.82			689
60	SM1505									14
	SM2005									10
	MM7510	2.27								82
	SM1510									53
	SM1513	1.63								77
	MM7515	0.63	1.06	1.58						190
	SM1515	0.78	1.30							127
	MM10020	0.39	0.65	0.97	1.29					236
	SM2020	0.45	0.75	1.12						167
	LDM1520	0.26	0.44	0.66	0.88	1.10				288
	HDM1525	0.13	0.21	0.32	0.42	0.53	1.05			549
	RM1410	1.94								79
	RM1215	0.53	0.89	1.33						188
	HDRM1220	0.15	0.25	0.37	0.50	0.62	1.24			560

CONCENTRATED LOAD



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- The allowable loads are for static load conditions at standard temperature 73°F +- 3.6°F (23°C +- 2°C).
- For applications involving dynamic loads, long-term loads that result in creep, or elevated temperature, consult Lichtgitter.
- For rectangular mesh grating the load bars need to be oriented in the SPAN direction.
- Grating support shall be >1" (25mm), gratings minimum length shall be >12" (305mm)
- Loading area for line load: 1" (25mm) wide x 12" (305mm) long (see sketch)

LOAD IN LB/FOOT OF WIDTH Deflection in inch

span in inches	typ	50	100	150	200	250	500	1000	2000	maximum recommened load (lb/ft)
12	SM1505	0.05	0.09	0.14						173
	SM2005	0.06	0.13							130
	MM7510	0.01	0.01	0.02	0.02	0.03	0.05			854
	SM1510	0.01	0.01	0.02	0.03	0.03	0.07			651
	SM1513	<0.01	0.01	0.01	0.02	0.02	0.04			944
	MM7515	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.03		1955
	SM1515	<0.01	<0.01	0.01	0.01	0.01	0.02	0.04		1551
	MM10020	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.02		1910
	SM2020	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.02		1843
	LDM1520	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.03	3282
	HDM1525	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	5170
	RM1410	<0.01	0.01	0.01	0.02	0.02	0.05			899
	RM1215	<0.01	<0.01	<0.01	0.01	0.01	0.01	0.03	0.05	2474
	HDRM1220	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	6771
18	SM1505	0.16	0.31							112
	SM2005	0.22								76
	MM7510	0.02	0.03	0.05	0.07	0.08	0.17			595
	SM1510	0.02	0.04	0.07	0.09	0.11				415
	SM1513	0.01	0.03	0.04	0.05	0.06	0.13			606
	MM7515	<0.01	0.01	0.01	0.02	0.02	0.05	0.10		1348
	SM1515	0.01	0.01	0.02	0.02	0.03	0.06	0.12		1009
	MM10020	<0.01	0.01	0.01	0.01	0.02	0.03	0.06		1258
	SM2020	<0.01	0.01	0.01	0.02	0.02	0.04	0.08		1213
	LDM1520	<0.01	<0.01	0.01	0.01	0.01	0.02	0.04	0.09	2293
	HDM1525	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.04	4383
	RM1410	0.01	0.03	0.04	0.05	0.07	0.13			719
	RM1215	<0.01	0.01	0.01	0.02	0.02	0.04	0.08		1462
	HDRM1220	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.05	4431

LOAD IN LB/FOOT OF WIDTH Deflection in inch

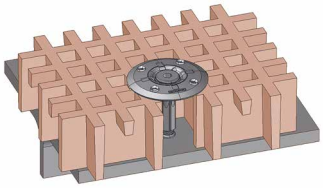
span in inches	typ	50	100	150	200	250	500	1000	2000	maximum recommened load (lb/ft)
24	SM1505	0.36								83
	SM2005	0.49								62
	MM7510	0.04	0.08	0.12	0.16	0.19				460
	SM1510	0.05	0.10	0.15	0.21	0.26				310
	SM1513	0.03	0.06	0.09	0.12	0.15				449
	MM7515	0.01	0.02	0.03	0.04	0.05	0.11	0.22		1045
	SM1515	0.01	0.03	0.04	0.06	0.07	0.14			741
	MM10020	0.01	0.01	0.02	0.03	0.03	0.07	0.14		1213
	SM2020	0.01	0.02	0.02	0.03	0.04	0.08			966
	LDM1520	<0.01	0.01	0.01	0.02	0.02	0.05	0.10		1686
	HDM1525	<0.01	<0.01	0.01	0.01	0.01	0.02	0.05	0.10	3259
	RM1410	0.03	0.07	0.11	0.14	0.18				449
	RM1215	0.01	0.01	0.02	0.03	0.04	0.07	0.15		1192
	HDRM1220	<0.01	0.01	0.01	0.01	0.01	0.03	0.05	0.11	3486
30	SM1505	0.71								67
	SM2005									47
	MM7510	0.07	0.15	0.23	0.30	0.37				375
	SM1510	0.10	0.20	0.30	0.40	0.49				250
	SM1513	0.06	0.11	0.17	0.23	0.28				364
	MM7515	0.02	0.04	0.06	0.08	0.10	0.21			854
	SM1515	0.03	0.05	0.08	0.11	0.14	0.27			593
	MM10020	0.01	0.03	0.04	0.05	0.06	0.13			944
	SM2020	0.02	0.03	0.05	0.06	0.08	0.16			730
	LDM1520	0.01	0.02	0.03	0.04	0.05	0.09	0.19		1348
	HDM1525	<0.01	0.01	0.01	0.02	0.02	0.05	0.09	0.18	2607
	RM1410	0.07	0.13	0.20	0.27	0.33				368
	RM1215	0.02	0.04	0.06	0.07	0.09	0.18			877
	HDRM1220	0.01	0.01	0.02	0.02	0.03	0.05	0.10	0.21	2677
36	SM1505	1.21								56
	SM2005									41
	MM7510	0.13	0.25	0.39	0.51	0.64				319
	SM1510	0.17	0.34	0.51	0.68					206
	SM1513	0.10	0.19	0.29	0.39	0.48				301
	MM7515	0.04	0.07	0.11	0.14	0.18	0.36			719
	SM1515	0.05	0.09	0.14	0.19	0.23				494
	MM10020	0.02	0.04	0.06	0.09	0.11	0.21			854
	SM2020	0.03	0.05	0.08	0.11	0.13	0.27			640
	LDM1520	0.02	0.03	0.05	0.06	0.08	0.16	0.32		1124
	HDM1525	0.01	0.02	0.02	0.03	0.04	0.08	0.15	0.31	2158
	RM1410	0.11	0.23	0.35	0.47	0.58				305
	RM1215	0.03	0.06	0.09	0.12	0.15	0.31			765
	HDRM1220	0.01	0.02	0.03	0.03	0.04	0.09	0.17	0.35	2294
42	SM1505									48
	SM2005									34
	MM7510	0.20	0.40	0.61	0.81	1.01				276
	SM1510	0.27	0.53	0.81						178
	SM1513	0.15	0.30	0.46	0.61	0.76				258
	MM7515	0.06	0.11	0.17	0.22	0.28	0.56			629
	SM1515	0.07	0.15	0.22	0.29	0.37				415
	MM10020	0.03	0.07	0.10	0.13	0.17	0.33			730
	SM2020	0.04	0.08	0.13	0.17	0.21	0.42			528
	LDM1520	0.02	0.05	0.08	0.10	0.12	0.25			955
	HDM1525	0.01	0.02	0.04	0.05	0.06	0.12	0.24		1843
	RM1410	0.17	0.35	0.53	0.70	0.88				285
	RM1215	0.05	0.10	0.15	0.20	0.25	0.49			637
	HDRM1220	0.01	0.03	0.04	0.06	0.07	0.14	0.28		1912

LOAD IN LB/FOOT OF WIDTH Deflection in inch

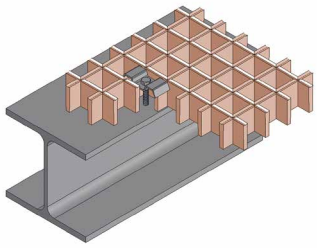
span in inches	typ	50	100	150	200	250	500	1000	2000	maximum recommened load (lb/ft)
48	SM1505									42
	SM2005									31
	MM7510	0.30	0.59	0.90	1.20					242
	SM1510	0.40	0.79	1.21						157
	SM1513	0.22	0.45	0.68	0.91					227
	MM7515	0.08	0.16	0.25	0.33	0.41	0.83			550
	SM1515	0.11	0.22	0.33	0.44	0.54				370
	MM10020	0.05	0.10	0.15	0.20	0.24	0.49			663
	SM2020	0.06	0.12	0.19	0.25	0.31				481
	LDM1520	0.04	0.07	0.11	0.15	0.18	0.37			843
	HDM1525	0.02	0.04	0.05	0.07	0.09	0.18	0.36		1618
	RM1410	0.27	0.54	0.82	1.09					231
	RM1215	0.07	0.14	0.22	0.29	0.36	0.72			574
	HDRM1220	0.02	0.04	0.06	0.08	0.10	0.20	0.41		1732
54	SM1505									38
	SM2005									26
	MM7510	0.42	0.84	1.28	1.70					220
	SM1510	0.56	1.12							139
	SM1513	0.32	0.64	0.97	1.29					202
	MM7515	0.12	0.23	0.35	0.47	0.59	1.17			500
	SM1515	0.15	0.31	0.47	0.62	0.77				330
	MM10020	0.07	0.14	0.21	0.28	0.35	0.69			595
	SM2020	0.09	0.18	0.27	0.35	0.44				415
	LDM1520	0.05	0.10	0.16	0.21	0.26	0.52			741
	HDM1525	0.02	0.05	0.08	0.10	0.13	0.25	0.50		1438
	RM1410	0.38	0.75	1.15	1.52					209
	RM1215	0.10	0.20	0.31	0.41	0.52				497
	HDRM1220	0.03	0.06	0.09	0.12	0.14	0.29	0.58		1507
60	SM1505									34
	SM2005									25
	MM7510	0.57	1.15	1.75	2.32					200
	SM1510	0.77	1.54							125
	SM1513	0.44	0.87	1.33						182
	MM7515	0.16	0.32	0.48	0.64	0.80				454
	SM1515	0.21	0.42	0.64	0.85	1.05				296
	MM10020	0.09	0.19	0.28	0.38	0.47	0.94			544
	SM2020	0.12	0.24	0.36	0.48	0.60				386
	LDM1520	0.07	0.14	0.22	0.29	0.36	0.71			674
	HDM1525	0.03	0.07	0.10	0.14	0.17	0.34	0.69		1303
	RM1410	0.52	1.04	1.59						186
	RM1215	0.14	0.28	0.42	0.56	0.70				459
	HDRM1220	0.04	0.08	0.12	0.16	0.20	0.39	0.79		1372

FIXINGS

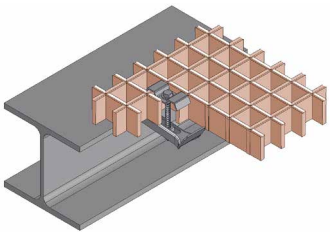
Cartridge-fired pin fixing
Composed of a spring cap with a firmly connected threaded sleeve and cartridge-fired pin. This fixing is suitable for mesh spacings of ca. 1" to 1½".



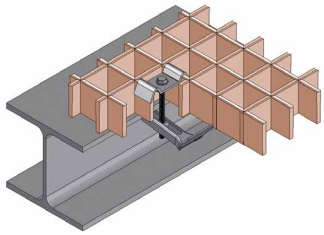
Direct screw joint
Composed of spring cap, bolt, washer, nut and plastic locking ring. This fixing can be fitted from above in conjunction with a self-cutting screw.



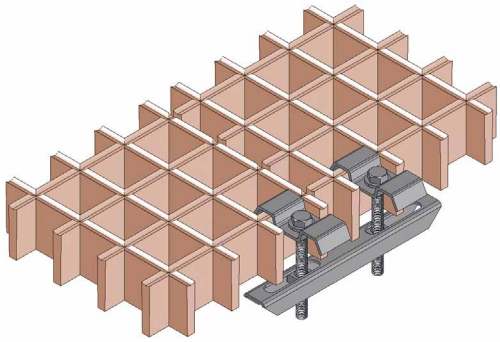
Standard fixing - 1-1/2" mesh
Composed of spring cap, clamp base, bolt, nut and plastic locking ring. This fixing can be fitted from above in a prefabricated state for mesh spacings of 1½" and above – screw lengths at least grating height plus 1½".

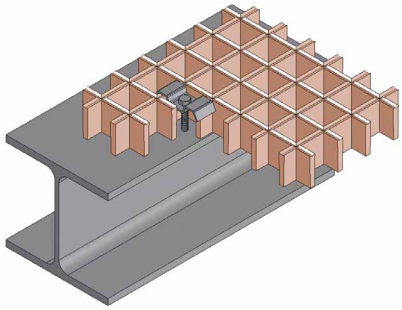


Standard fixing - 2" mesh
Composed of spring cap, clamp base, bolt, nut and plastic locking ring. This fixing can be fitted from above in a prefabricated state for mesh spacings of 2" and above – screw lengths minimum grating height plus 1½".



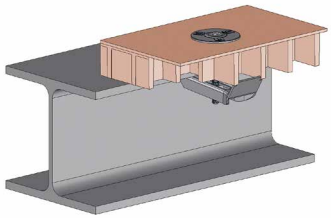
Double clamp fixing
Composed of spring caps, clamp base, bolts, nuts and plastic locking ring.
The double clamp fixing connects neighbouring gratings to points susceptible to greater amounts of deflection. It prevents trip hazards and can be fitted from above - screw lengths at least grating height plus1¼".

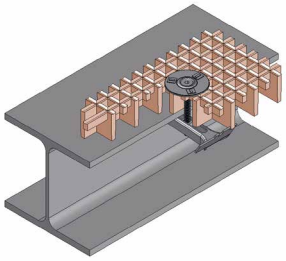




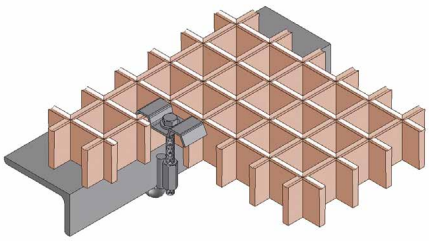
Stairtread fixing
Composed of clamp top, bolt, self-fastening nut and washer.
The stairtread fixing connects stairtread gratings with the support brackets of the stair framework. Each stairtread grating is secured with 4 fixings.

Standard fixing - closed or mini mesh
Composed of a special spring cap, clamp base, bolt, nut and plastic locking ring. This fixing was developed especially for closemesh FRP gratings – screw lengths at least grating height plus 1½".

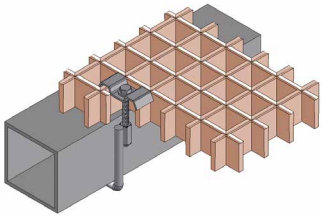




Hook bolt fixing - angle
Composed of a spring cap, hook bolt fit to the substructure, bolt, nut and plastic locking ring. The bracket profile of the substructure must be specified. This fixing can be fitted from above.

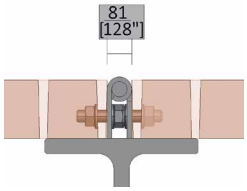


Hook bolt fixing - tube
Composed of a spring cap, hook bolt fit to the substructure, bolt, nut and plastic locking ring. The U-profile of the substructure must be specified. This fixing can be fitted from above.



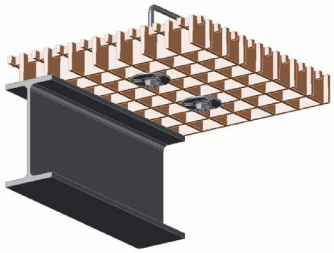
Hinge
Composed of:
- 2 hinge plates
- 1 hinge pin
- 2 U-washers
- 2 cotter pins

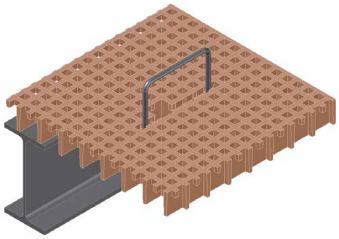
Hinges can be supplied in galvanized steel, stainless steel 304 and stainless steel 316.

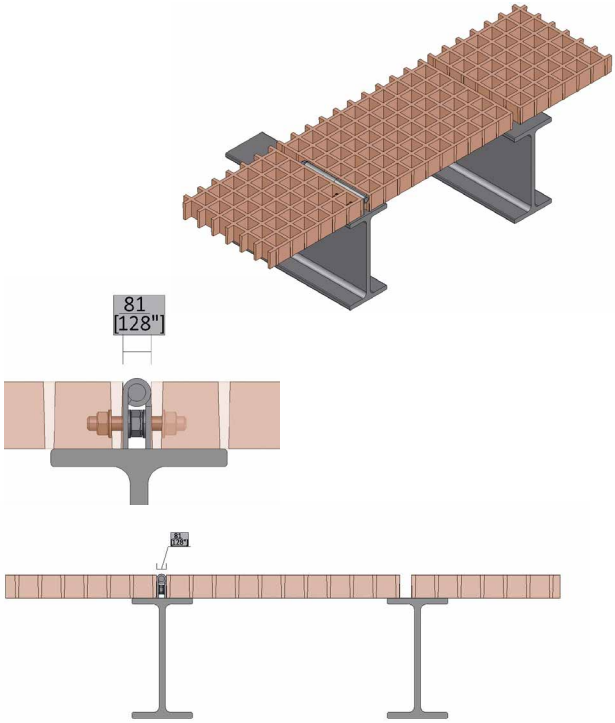


Lifting handle
Composed of:
- Handle XB 115
- 2 spring caps
- 2 nuts

The lifting handle can also be used for solid FRP gratings. Lifting handles can be supplied in galvanized steel, stainless steel 304 and stainless steel 316.





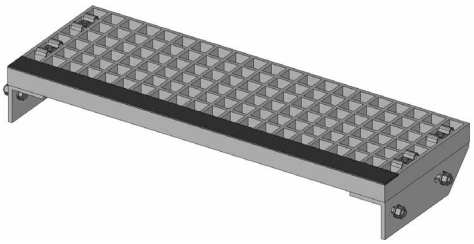


STAIRTREADS

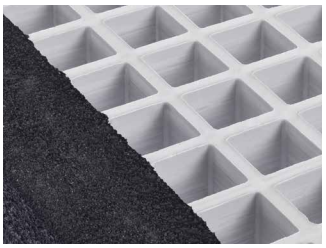
Lichtgitter molded FRP stair treads provide the same level of slip resistance, non-conductivity, strength and corrosion resistance as other molded FRP products. They are supplied with an angle nosing or a flat nosing as shown in the pictures below. Both nosing's have a grit surface to ensure optimum slip resistance. The angle of the anlge-nosing-option additionally reinforces the front of the step and is therefore used for larger spans.Lichtgitter supplies molded FRP stair treads with flat nosing in 1'x12' with a 1-1/2" depth and 1-1/2"x1-1/2" mesh as standard. Other sizes and types are available upon request. We also offer several types of fastening solutions to ensure effective installation.

Lichtgitter also offers matching side plates made of FRP as an additional product. Please contact our technical support for further information.

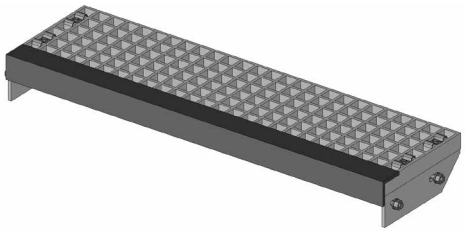
Molded stair tread with flat nosing



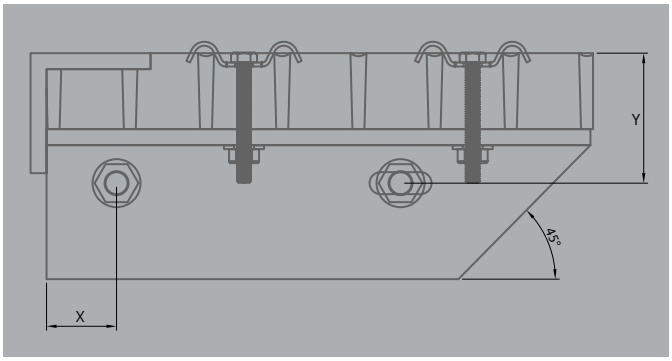
Molded stair tread with flat nosing and side plates



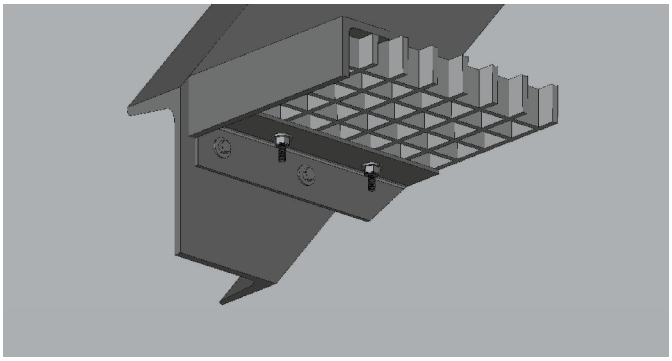
Molded stair tread with angle nosing



Molded stair tread with angle nosing and side plates



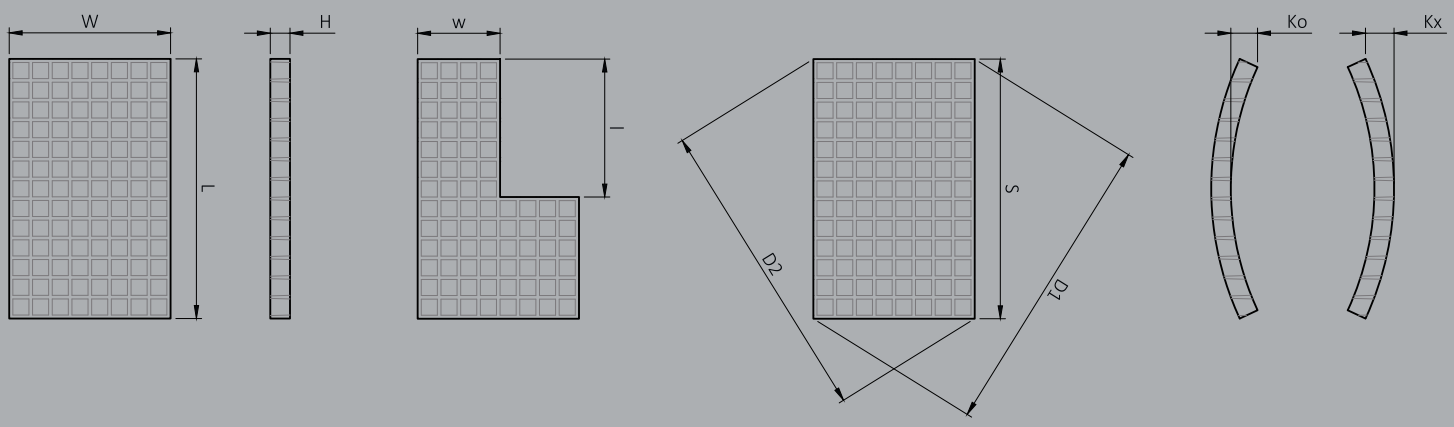
Detail side plate



Assembly example

TOLERANCES OF FRP GRATINGS

Lichtgitter FRP gratings are subject to fixed production and delivery tolerances.



Length deviations and width deviations
W; L = max. + 0" to - 1/6"

Height deviations
H = max. + 1/12" / - 1/12"

Sections:
w; l = max. + 1/3" / - 0"

Diagonal deviation
Difference of measured diagonals D1 minus D2 max. 0.010 x S (longest side length)

Evenness:
Deviation for convex (Kx) in length and width: max. 1/3"
Deviation for concave (Ko) in length and width: max. 1/3"

Note: Single-sided closed FRP gratings may be subject to increased warping.

SPECIAL APPLICATIONS

HEIGHT-ADJUSTABLE POSITIONING MOUNTS

Height-adjustable plastic mounts are versatile and cost-effective for various applications. Our product line includes both “Easy” and “Comfort” Lichtgitter positioning mounts. “Comfort” mounts offer up to 5% angle adjustment, ensuring a level surface even on gradients.

The major advantages:

- low priced substructure
- quick assembly
- easily dismantled
- very resistant
- UV and weather resistant
- Height can be controlled to the millimetre
- Reinforced stands provide high load capacities
- Rounded edges to prevent damaging the subsurface

SAFETY PLATE / SAFETY TREAD

Our safety plate and safety tread is a simple, cost-effective stair and platform covering made from FRP, designed to be added to stairs and floorings to make them safer. The sanded covering has been designed for concrete, metal and wooden stairs and floorings and is easy to fit. The safety covering is mainly used in areas where slippery smooth surfaces pose a threat.

The bright marking of the yellow colored nosing on the safety tread increases safety.

PULTRUDED PROFILES

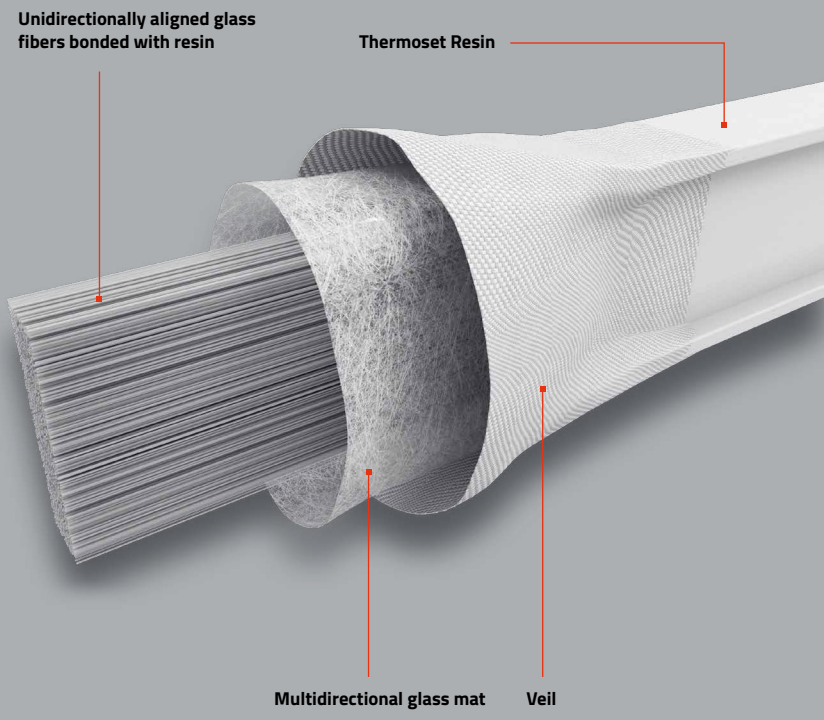
PULTRUSION IS A CONTINUOUS MANUFACTURING PROCESS USED TO CREATE COMPOSITE PROFILES WITH UNIFORM CROSS-SECTIONS AND PROPERTIES TAILORED FOR SPECIFIC APPLICATIONS. DATING BACK TO THE 1950S, IT ENSURES CONSISTENT QUALITY BY PULLING CONTINUOUS REINFORCED MATERIAL THROUGH GUIDES, WHERE FIBERS ARE METICULOUSLY POSITIONED WITHIN THE PROFILE CROSS-SECTION. SUBSEQUENTLY, THE FIBERS ARE IMPREGNATED WITH MATRIX MATERIAL AND HEATED TO CURE THE PROFILE TO ITS FINAL SHAPE. A CRITICAL ASPECT IS THE PRECISE ARRANGEMENT OF REINFORCEMENTS, WHICH IMPACTS THE PROPERTIES OF THE END PRODUCT.

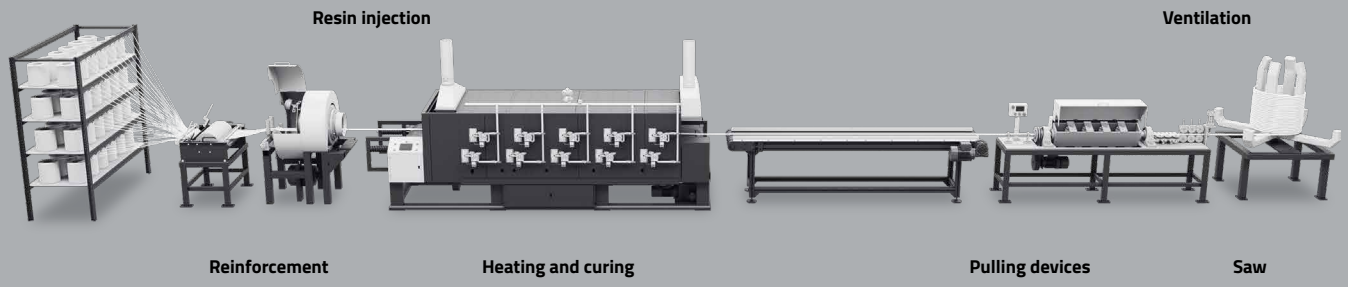
PULTRUSION PROCESS

Pultrusion is a continuous manufacturing process used to create composite profiles with uniform cross-sections and properties tailored for specific applications. Dating back to the 1950s, it ensures consistent quality by pulling continuous reinforced material through guides, where fibers are meticulously positioned within the profile cross-section. Subsequently, the fibers are impregnated with matrix material and heated to cure the profile to its final shape. A critical aspect is the precise arrangement of reinforcements, which impacts the properties of the end product.

Injection pultrusion enhances control and speed, facilitating quick profile changes and optimal impregnation. Unlike traditional pultrusion, it minimizes solvent evaporation due to its enclosed nature, contributing to a safer work environment. The curing process occurs in stages, with final curing ensuring dimensional stability. External pullers provide the necessary force to overcome friction, enabling continuous production. Profiles are then cut seamlessly for a smooth workflow.

A pultruded profile contains three main components: reinforcement, matrix and additives





Reinforcement: Reinforcement improves mechanical properties such as strength and stiffness, with variations in fiber types affecting electrical properties. Common reinforcements include glass, carbon and aramid fibers. Fiber orientation is critical to load capacity and resistance to shear. Profiles typically contain a combination of rovings, mats, and weaves tailored to specific requirements, with a structural profile typically containing 60% reinforcement by weight.

Matrix: The matrix binds the reinforcement and determines properties such as corrosion resistance and fire retardancy. Polyester, epoxy and phenolic matrices are commonly used. Polyester offers versatile properties, while epoxy improves fatigue and mechanical strength, especially in carbon-reinforced profiles. Phenolic is selected for high fire resistance.

Additives: Additives serve multiple purposes and influence corrosion resistance, mechanical and fire properties. Price-reducing additives fill profiles, reducing costs, but also affect mechanical and corrosion resistance. Process-related additives improve the pultrusion process and profile appearance, while functional additives improve usability. Examples include pigments for color and flame retardants for self-extinguishing properties. Proper testing ensures optimal additive levels without compromising profile performance.

QUALITY STANDARDS

The values given in the following table should be considered as minimum values.

		Imperial		Metric	
Mechanical properties	**Standard**	**Value**	**Unit**	**Value**	**Unit**
tensile stress, LW	ASTM D638	30.000,00	psi	206,80	Mpa
tensile stress, CW	ASTM D638	7.000,00	psi	48,20	Mpa
tensile modulus, LW	ASTM D638	2,50	10(6) psi	17,20	Gpa
tensile modulus, CW	ASTM D638	0,80	10(6) psi	5,50	Gpa
compressive stress, LW	ASTM D695	30.000,00	psi	206,80	Mpa
compressive stress, CW	ASTM D695	15.000,00	psi	103,40	Mpa
compressive modulus, LW	ASTM D695	2,50	10(6) psi	17,20	Gpa
compressive modulus, CW	ASTM D695	1,00	10(6) psi	6,90	Gpa
flexural stress, LW	ASTM D790	30.000,00	psi	206,80	Mpa
flexural stress, CW	ASTM D790	10.000,00	psi	68,90	Mpa
flexural modulus, LW	ASTM D790	1,80	10(6) psi	11,00	Gpa
flexural modulus, CW	ASTM D790	0,80	10(6) psi	5,50	Gpa
modulus of elasticity, E	full section	2,60	10(6) psi	17,90	Gpa
shear modulus	ASTM D5379	0,43	10(6) psi	2,90	Gpa
ultimate Bearing Stress, LW	ASTM D953	30.000,00	psi	206,80	Mpa
ultimate Bearing Stress, CW	ASTM D953	30.000,00	psi	206,80	Mpa
poisson´s ration, LW	ASTM D3039	0,33	in/in	0,33	mm/mm
notched izod impact, LW	ASTM D256	25,00	ft-lbs/in	1,28	J/mm
notched izod impact, CW	ASTM D256	4,00	ft-lbs/in	0,20	J/mm
pin-bearing strenght, LW	Annex. E, EN 13706-2:2002	21.800,00	Mpa	150,00	Mpa
pin-bearing strenght, LW	Annex. E, EN 13706-2:2002	10.200,00	Mpa	70,00	Mpa

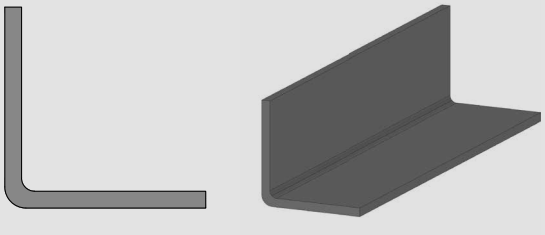
		Imperial		Metric	
Physical properties	**Standard**	**Value**	**Unit**	**Value**	**Unit**
barcol hardness	ASTM D2583	45,00	--	45,00	--
24 hours water absorbtion	ASTM D570	0,60	% max	0,60	% max
density	ASTM D792	0,062-0,070	lbs/in3	1.72 - 1.95	g/cc
coefficient of thermal expansion, LW	ASTM D696	7,00	10(-6) in/in/°F	12,60	10-6cm/cm/°C
thermal conductivity	ASTM C177	4,00	BTU/SF/Hr/OF/in	0,58	W-m/m(2)/°C

		Imperial		Metric	
Electrical properties	**Standard**	**Value**	**Unit**	**Value**	**Unit**
arc resistance, LW	ASTM D495	120,00	seconds	120,00	seconds
dielectric strength, LW	ASTM D149	35,00	kv./inch	1,38	kv./mm
dielectric strength, PF	ASTM D149	200,00	volts/mil	7,87	kv./mm
dielectric constant, PF	ASTM D150	5,00	@60hz	5,00	@60hz

		Imperial	Metric
Flammability properties	**Standard**		
flame spread index (FSI)	ASTM E84	15 max.	15 max.
smoke development index (SDI)	ASTM E84	450 max.	450 max.
flammalility	ASTM D635	No Burning(Pass < 25mm)	No Burning(Pass < 25mm)
UL	94	V0	V0
NBS smoke chamber	E-662	Smoke Density 600-700	Smoke Density 600-700

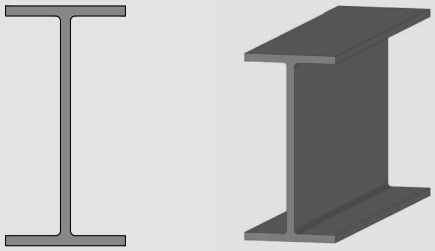
Notes: - LW = lenghtwise, CW = crosswise, PF = perpendicular to laminate face
- The above values refer exclusively to polyster profiles. Vinylester profiles may achieve higher values.
- This list is exclusively for pultruded profiles. Please contact us if you have any questions about the requirements of pultruded flatsheets.

STANDARD PROFILES



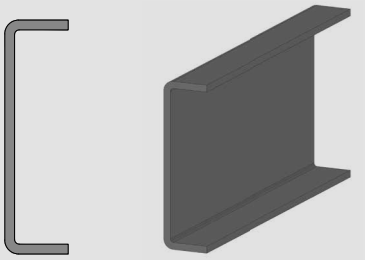
PULTRUDED PROFILES

Typ	Size	Thickness	Length
Equal Leg Angle	1-1/2″	1/8″	20′
Equal Leg Angle	1-1/2″	1/4″	20′
Equal Leg Angle	2″	1/8″	20′
Equal Leg Angle	2″	1/4″	20′
Equal Leg Angle	3″	1/4″	20′
Equal Leg Angle	3″	3/8″	20′
Equal Leg Angle	4″	1/4″	20′
Equal Leg Angle	4″	3/8″	20′
Equal Leg Angle	4″	1/2″	20′
Equal Leg Angle	6″	1/4″	20′
Equal Leg Angle	6″	3/8″	20′



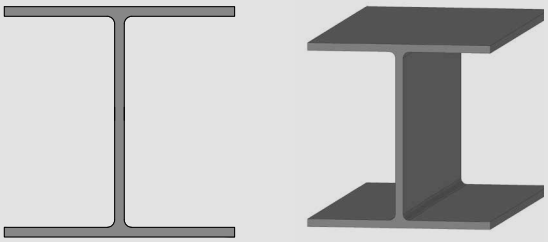
PULTRUDED PROFILES

Typ	Size	Thickness	Length
I-Beam (I-Profile)	3-1/2" x 1-1/2"	3/16"	20'
I-Beam (I-Profile)	4" x 2"	1/4"	20'
I-Beam (I-Profile)	5-1/2" x 2-1/2"	1/4"	20'
I-Beam (I-Profile)	6" x 2"	1/4"	20'
I-Beam (I-Profile)	6" x 3"	1/4"	20'
I-Beam (I-Profile)	6" x 3"	3/8"	20'
I-Beam (I-Profile)	8" x 4"	1/4"	20'
I-Beam (I-Profile)	8" x 4"	3/8"	20'
I-Beam (I-Profile)	10" x 5"	1/2"	20'



PULTRUDED PROFILES

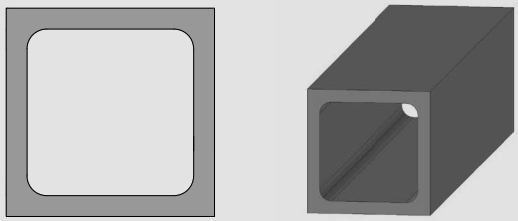
Typ	Size	Thickness	Length
Channel (U-Pofile)	3" x 1"	1/4"	20'
Channel (U-Pofile)	3-1/2" x1-1/2"	3/16"	20'
Channel (U-Pofile)	3-1/2" x1-1/2"	1/4"	20'
Channel (U-Pofile)	4" x 1-1/8"	1/4"	20'
Channel (U-Pofile)	4" x 1-1/8"	3/8"	20'
Channel (U-Pofile)	4" x 1-3/8"	3/16"	20'
Channel (U-Pofile)	4" x 2"	1/4"	20'
Channel (U-Pofile)	5" x 1-3/8"	1/4"	20'
Channel (U-Pofile)	5-1/2" x 1-1/2"	3/16"	20'
Channel (U-Pofile)	5-1/2" x 1-1/2"	1/4"	20'
Channel (U-Pofile)	6" x 1-5/8"	1/4"	20'
Channel (U-Pofile)	6" x 1-11/16"	3/8"	20'
Channel (U-Pofile)	8" x 2-3/16"	1/4"	20'
Channel (U-Pofile)	8" x 2-3/16"	3/8"	20'
Channel (U-Pofile)	10" x 2-3/4"	1/2"	20'
Channel (U-Pofile)	14" x 3-1/2"	3/4"	20'



PULTRUDED PROFILES

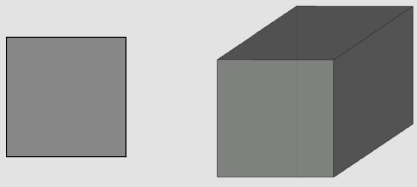
Typ	Size	Thickness	Length
WF-Beam (H-Profile)	4" x 4"	1/4"	20'
WF-Beam (H-Profile)	4" x 4"	3/8"	20'
WF-Beam (H-Profile)	6" x 6"	1/4"	20'
WF-Beam (H-Profile)	6" x 6"	3/8"	20'
WF-Beam (H-Profile)	8" x 8"	3/8"	20'
WF-Beam (H-Profile)	8" x 8"	1/2"	20'

STANDARD PROFILES



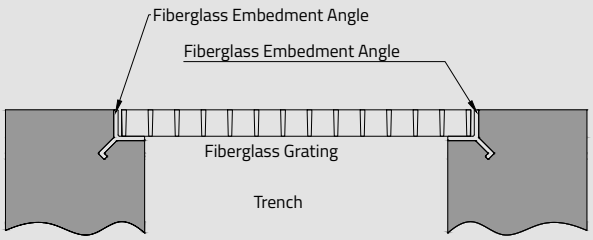
PULTRUDED PROFILES

Typ	Size	Thickness	Length
Square Tube	1" x 1"	1/8"	20'
Square Tube	1-1/4" x 1-1/4"	1/4"	20'
Square Tube	1-1/2" x 1-1/2"	1/8"	20'
Square Tube	1-1/2" x 1-1/2"	1/4"	20'
Square Tube	1-3/4" x 1-3/4"	1/8"	20'
Square Tube	1-3/4" x 1-3/4"	1/4"	20'
Square Tube	2" x 2"	1/8"	20'
Square Tube	2" x 2"	1/4"	20'
Square Tube	2-1/2" x 2-1/2"	1/8"	20'
Square Tube	2-1/2" x 2-1/2"	1/4"	20'
Square Tube	3" x 3"	1/8"	20'
Square Tube	3" x 3"	1/4"	20'
Square Tube	3" x 3"	3/8"	20'
Square Tube	3-1/2" x 3-1/2"	1/8"	20'
Square Tube	3-1/2" x 3-1/2"	1/4"	20'
Square Tube	3-1/2" x 3-1/2"	3/8"	20'
Square Tube	4" x 4"	1/8"	20'
Square Tube	4" x 4"	1/4"	20'
Square Tube	4" x 4"	3/8"	20'
Square Tube	6" x 6"	3/8"	20'



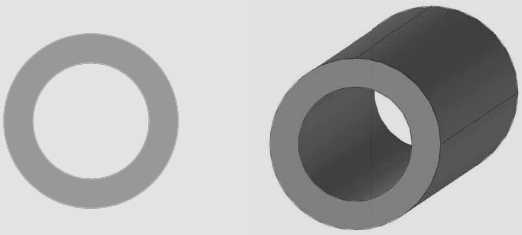
PULTRUDED PROFILES

Typ	Size	Thickness	Length
Square Bar	1" x 1"		20'
Square Bar	1-1/4" x 1-1/4"		20'
Square Bar	1-1/2" x 1-1/2"		20'
Square Bar	1-3/4" x 1-3/4"		20'
Square Bar	2" x 2"		20'



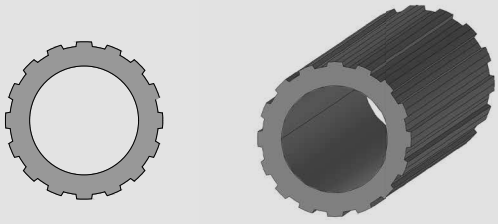
PULTRUDED PROFILES

Typ	Size	Thickness	Length
Embedment Angle	1" x 1-1/2"	1/4"	20'
Embedment Angle	1-1/2" x 1-1/2"	1/4"	20'
Embedment Angle	2" x 1-1/2"	1/4"	20'



PULTRUDED PROFILES

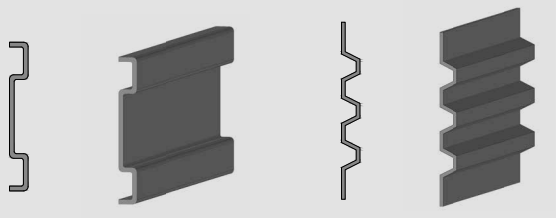
Typ	Size	Thickness	Length
Round Tube	1-1/2"	1/4"	20'
Round Tube	2"	1/8"	20'
Round Tube	2"	1-3/64"	20'



PULTRUDED PROFILES

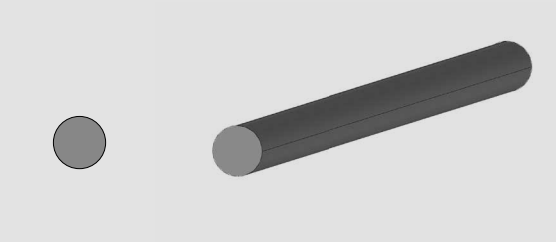
Typ	Size	Thickness	Length
Ladder Rung	1-1/4"	0.130	20'
Ladder Rung	1-1/4"	0.160	20'
Ladder Rung	1-1/4"	0.200	20'
Ladder Rung	1-1/4"	0.240	20'
Ladder Rung	1-1/4"	0.320	20'

STANDARD PROFILES



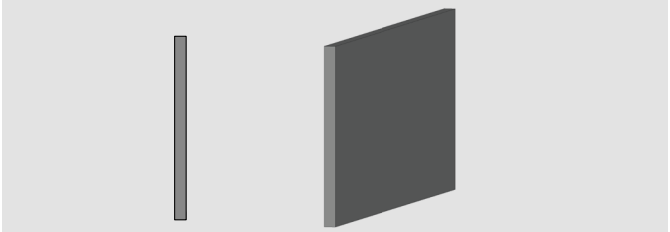
PULTRUDED PROFILES

Typ	Size	Thickness	Length
Toe Plate (kickplate)	4" x 1/2"	1/8"	20'
Toe Plate (kickplate)	6" x 5/8"	1/8"	20'



PULTRUDED PROFILES

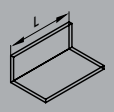
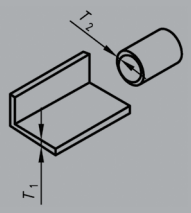
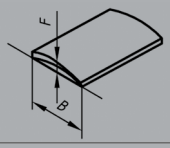
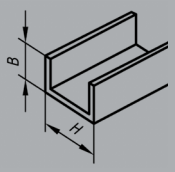
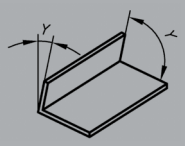
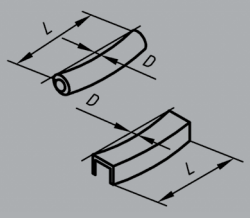
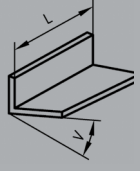
Typ	Size	Thickness	Length
Round Rod	3/8"		20'
Round Rod	1/2"		20'
Round Rod	5/8"		20'
Round Rod	3/4"		20'
Round Rod	1"		20'



PULTRUDED PROFILES

Typ	Size	Thickness	Length
Flat Sheet	2"	1/4"	20'
Flat Sheet	2-1/2"	3/16"	20'
Flat Sheet	3"	1/8"	20'
Flat Sheet	3"	1/4"	20'
Flat Sheet	3"	3/8"	20'
Flat Sheet	4"	1/8"	20'
Flat Sheet	4"	1/4"	20'
Flat Sheet	4"	3/8"	20'
Flat Sheet	4"	1/2"	20'
Flat Sheet	48"	1/8"	8'
Flat Sheet	48"	1/4"	8'
Flat Sheet	48"	3/8"	8'
Flat Sheet	48"	1/2"	8'

TOLERANCES

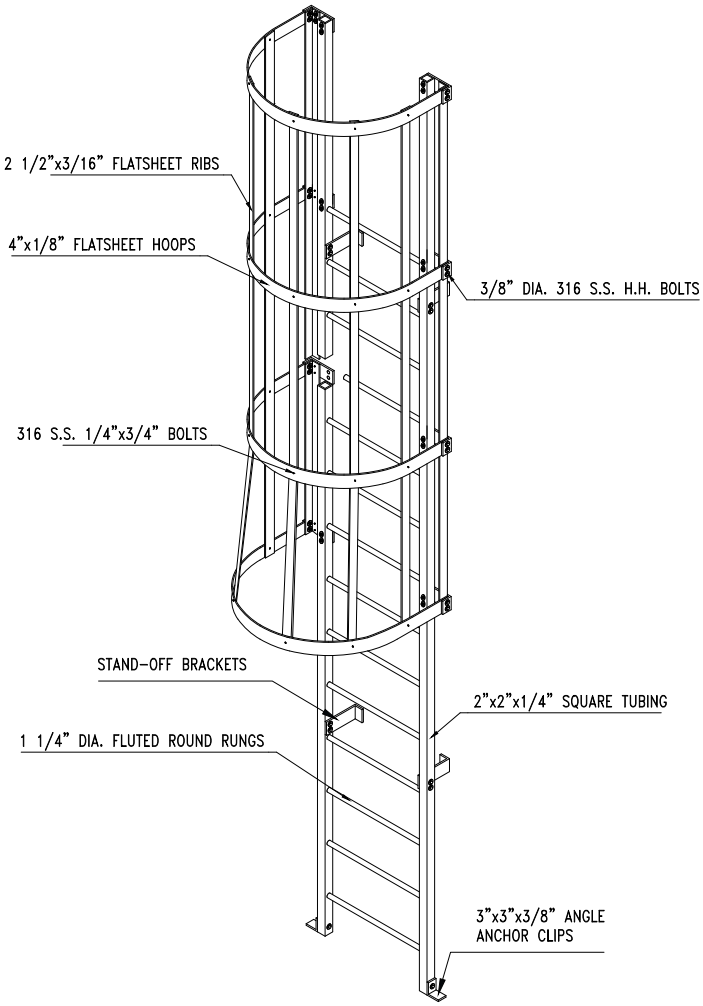
PROPERTY	TOLERANCES	DRAWING
Length of Product (Standard Profiles)	(L) – 1/6" / + 2/7"	
Wall thickness of open and closed profiles	(T1) material thickness 1/13"–1/5": ± 0.008" (T1) Material thickness 1/5"–2/5": ± 0.014" (T1) Material thickness >2/5": ± 0.018" (T2) material thickness: +10% with minimum ± 0.012"	
Flatness in the transverse direction	F < 0,008 x B	
Profile height and width of flange	Nominal dimensions B and H: ± 0.5% with minimum ± 0.008" and maximum ± 0.023"	
Size of angle	Y ± 1.5°	
Straightness	D < 0,002 x L² for sections with width or height < 2" D < 0,001 x L² for profiles with width or height > 2" and < 4" D < 0,0005 x L² for profiles with width or height > 4" (D and L is in feet) (B and H are overall width and height dimensions)	
Twist	V < 1.5° per 4ft maximum for thickness < 1/5" Y < 1,0° per 4ft maximum for thickness ≥ 1/5"	

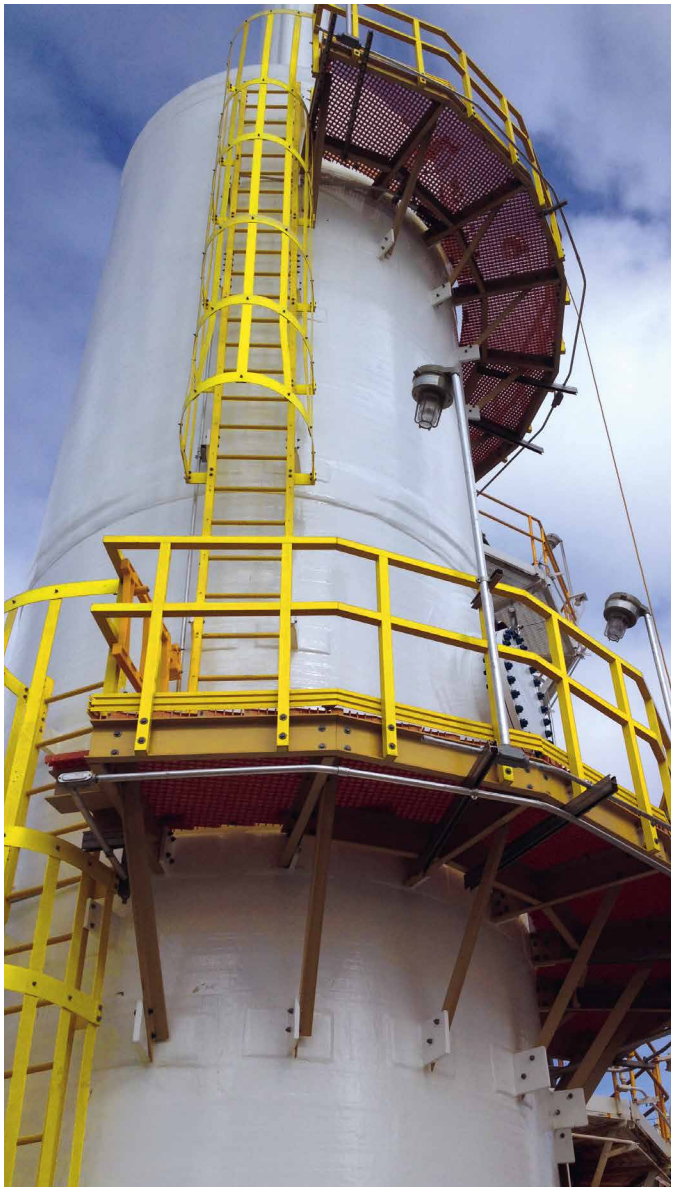
VERTICAL LADDER

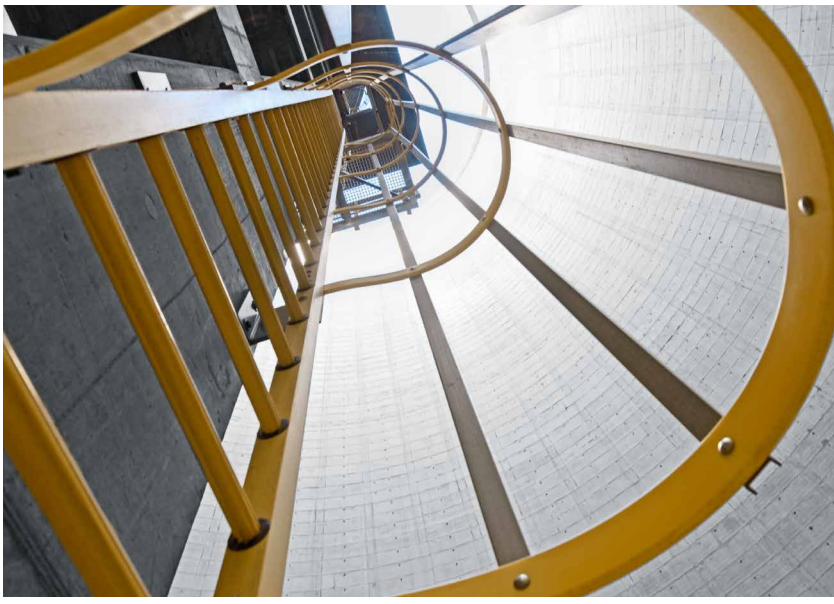
Lichtgitter FRP vertical ladders are made of pultruded FRP profiles and are constructed to provide excellent protection in areas with high corrosion. Easily transportable parts and simple assembly are an excellent alternative to traditional vertical ladders. The special fluted profile is used to construct the rungs – provide optimum non-slip safety. The safety cage also provides additional safety. Lichtgitter-FRP vertical ladders are suitable for both indoor and outdoor use and they meet OSHA requirements.

FRP LADDER W/CAGE

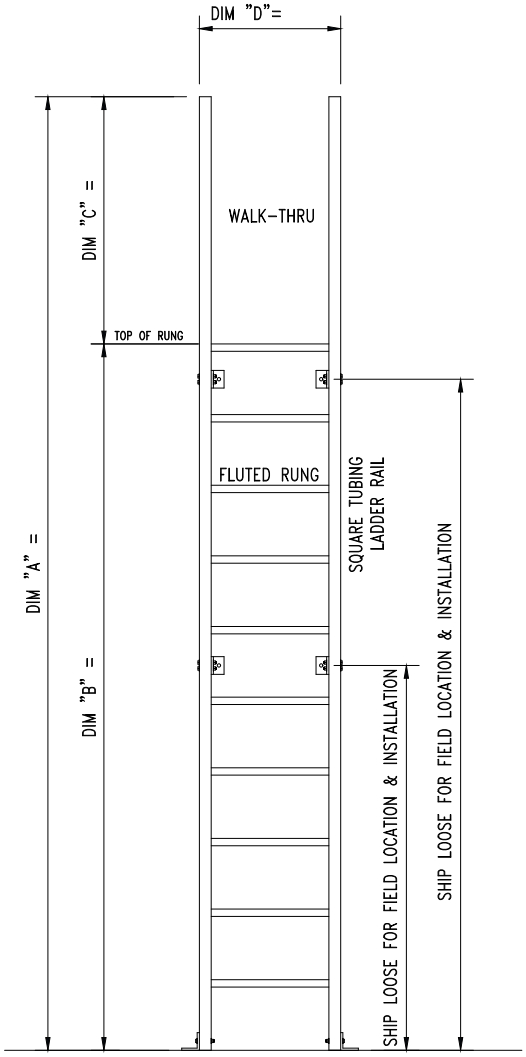
ISOMETRIC VIEW



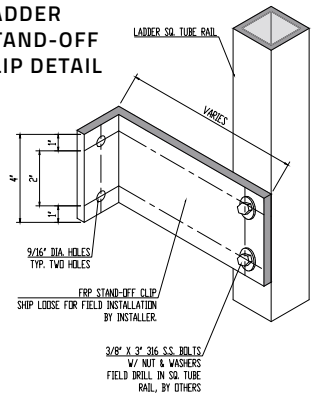




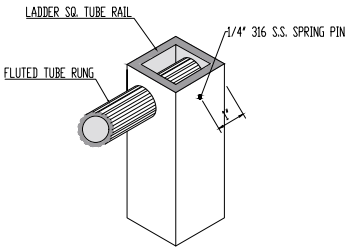
FRP LADDER

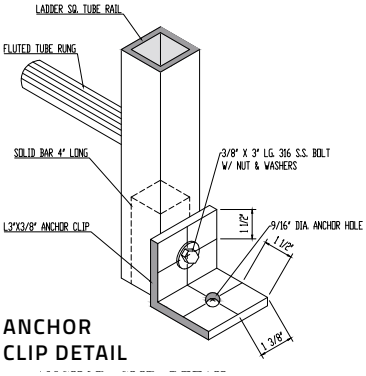


LADDER STAND-OFF CLIP DETAIL

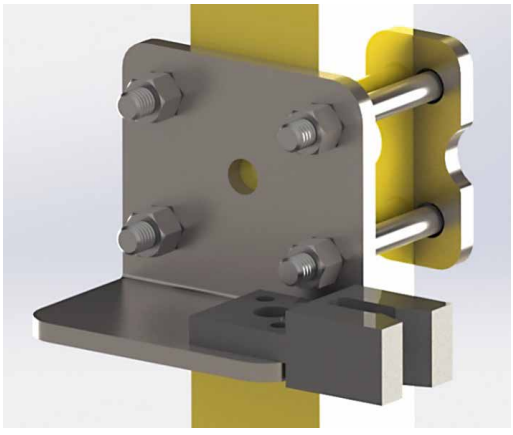


LADDER RUNG DETAIL





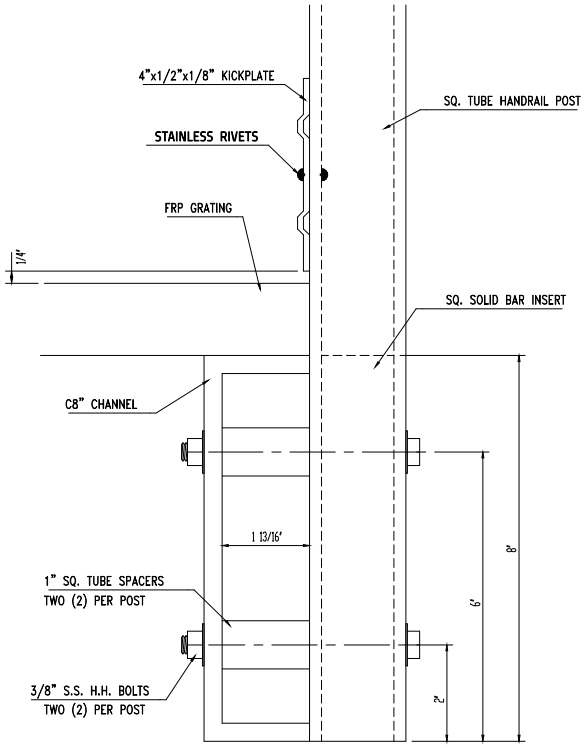
ANCHOR CLIP DETAIL

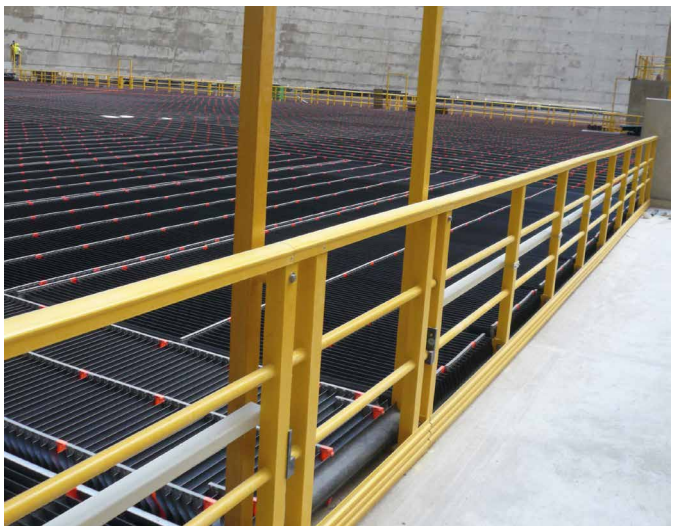


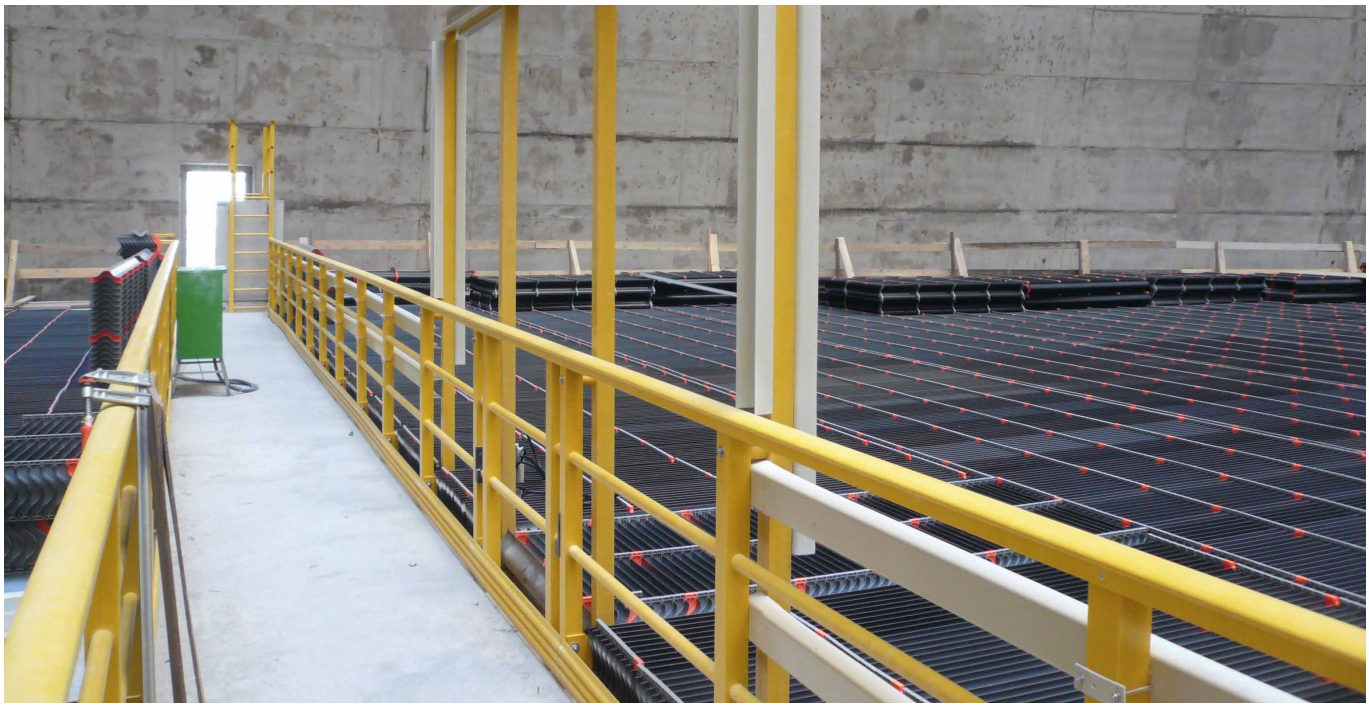
HANDRAILS

Our handrail systems are meticulously crafted using the pultrusion process, incorporating up to 70% glass fiber for unparalleled mechanical strength. Comprising a variety of pultruded shapes such as tubes, kick plates and solid inserts, these systems are designed to meet stringent OSHA requirements. Available in polyester and vinyester resin options, each system can optionally be supplied with a secondary clear U.V. coating for added durability and protection.

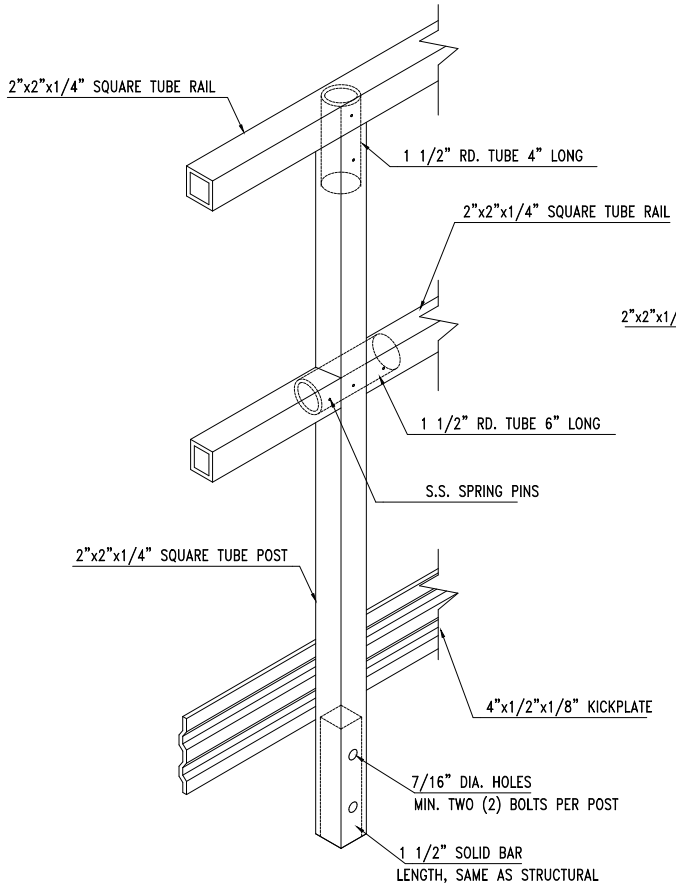
HANDRAIL TO 8" CHANNEL CONNECTION



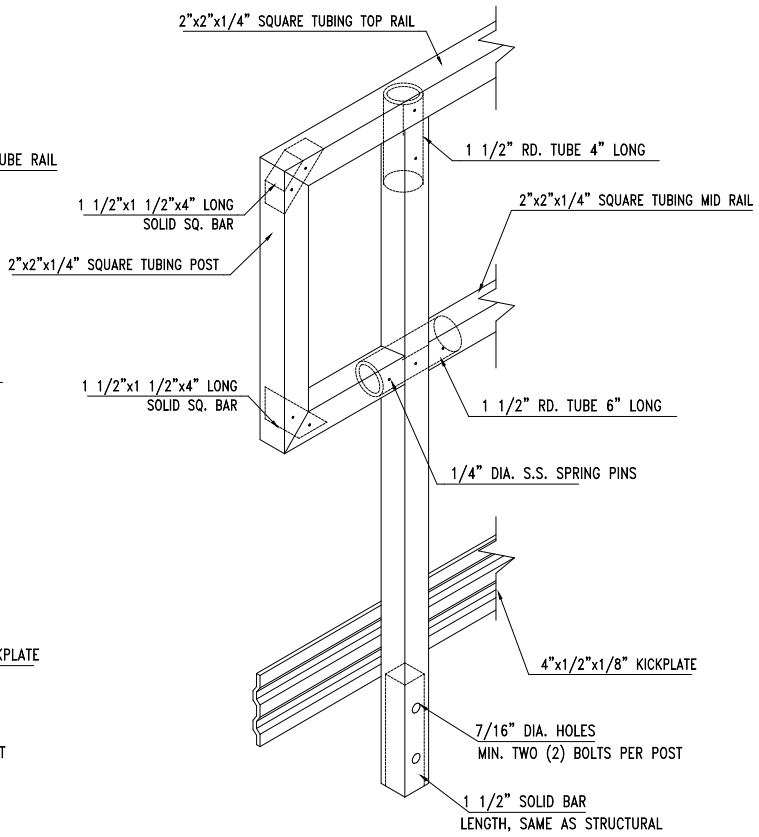


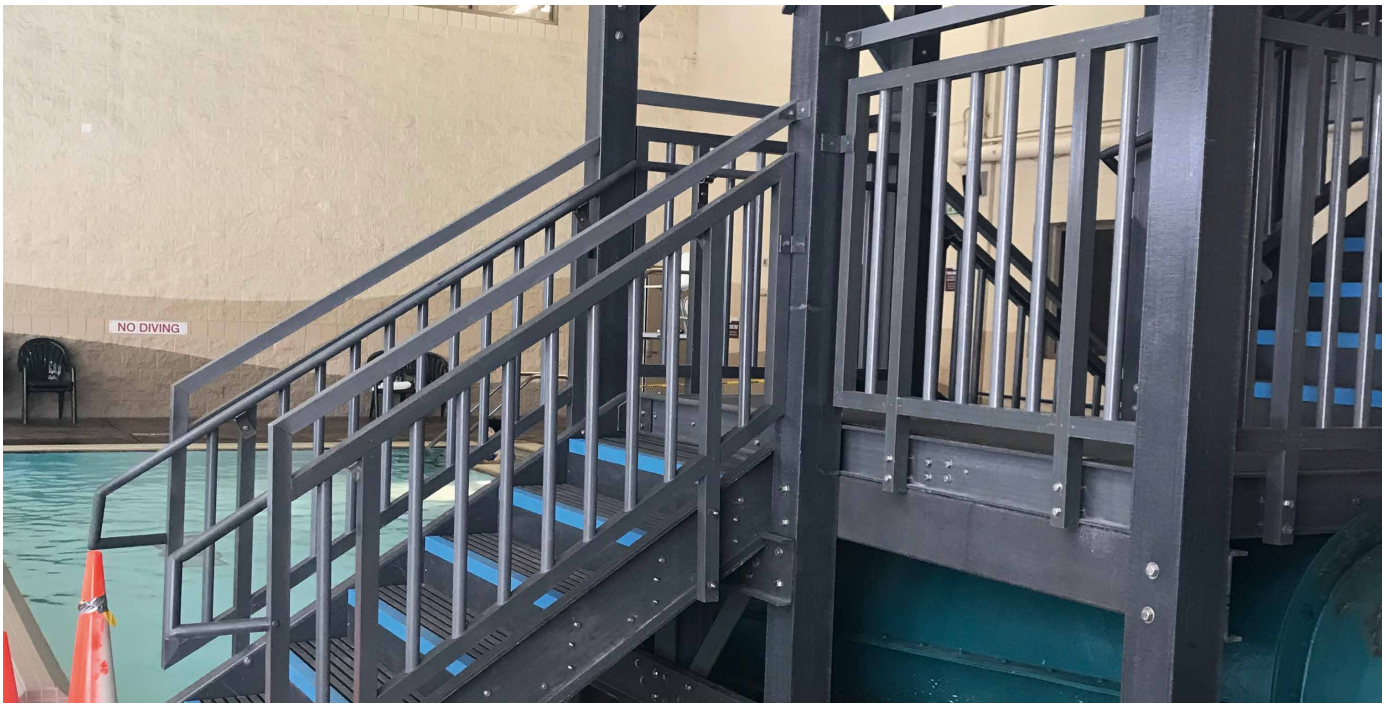


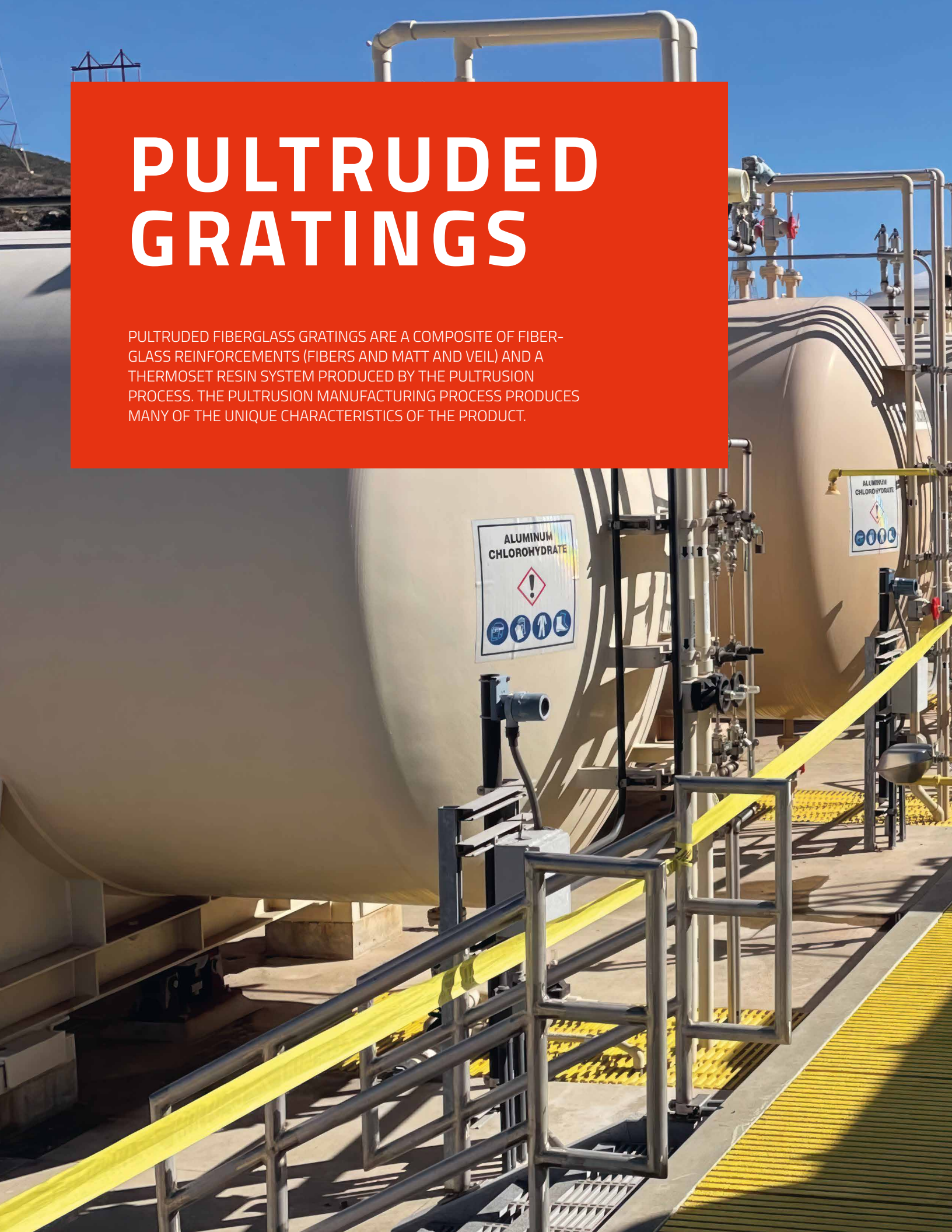
FRP SO. TUBE SIDE MOUNT RAILING



FRP 2-RAIL SIDE MOUNT RAILING







PULTRUDED GRATINGS

PULTRUDED FIBERGLASS GRATINGS ARE A COMPOSITE OF FIBER-GLASS REINFORCEMENTS (FIBERS AND MATT AND VEIL) AND A THERMOSET RESIN SYSTEM PRODUCED BY THE PULTRUSION PROCESS. THE PULTRUSION MANUFACTURING PROCESS PRODUCES MANY OF THE UNIQUE CHARACTERISTICS OF THE PRODUCT.

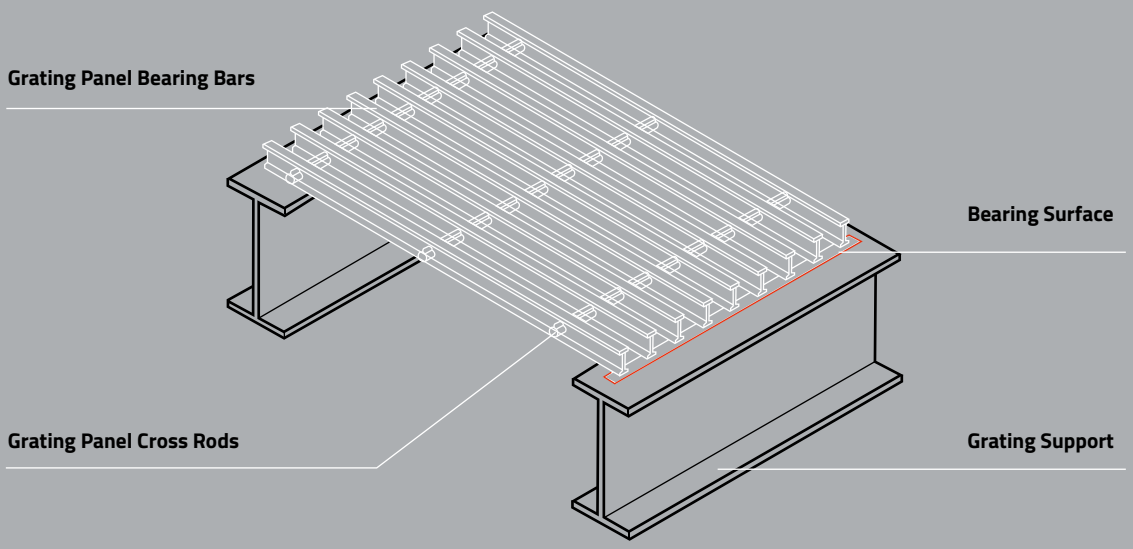
PULTRUDED GRATINGS

Pultruded Fiberglass Gratings are a composite of fiberglass reinforcements (Fibers and Mat and Veil) and a thermoset resin system produced by the pultrusion process. The pultrusion manufacturing process produces many of the unique characteristics of the product.

The bearing bars utilize both longitudinal (glass roving) and multi-directional (glass mat & veil) reinforcements. The densely packed core of continuous glass rovings provides strength and stiffness in the longitudinal direction, while the continuous glass mat provides strength in the transverse direction, preventing chipping, cracking, and linear breakage. The matrix provides corrosion resistance and the coated surface protects the grating from UV radiation.

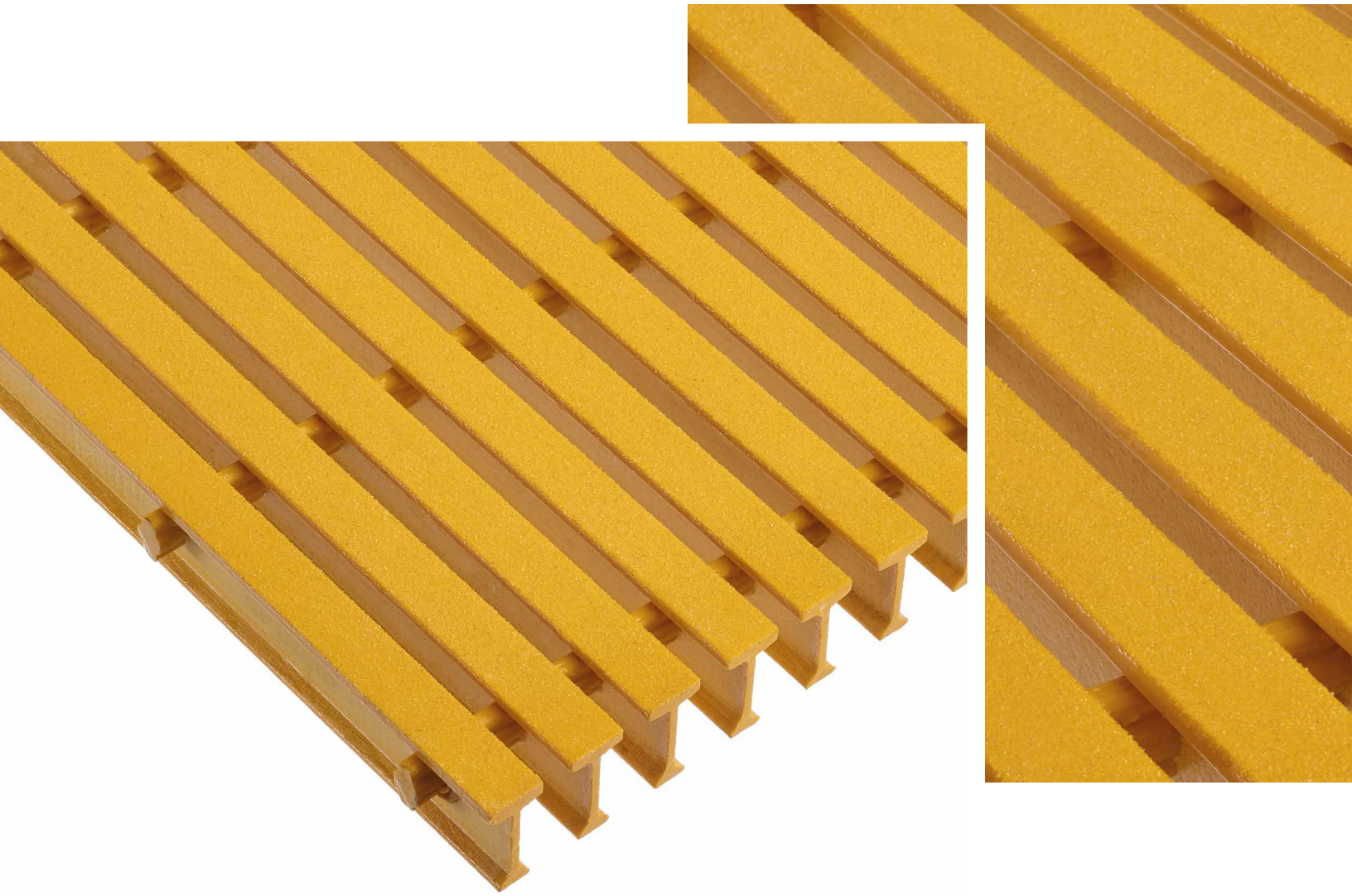
In addition, the anti-slip surface provides an optimum R13 stability in accordance with DIN 51130.

DESIGN ILLUSTRATION

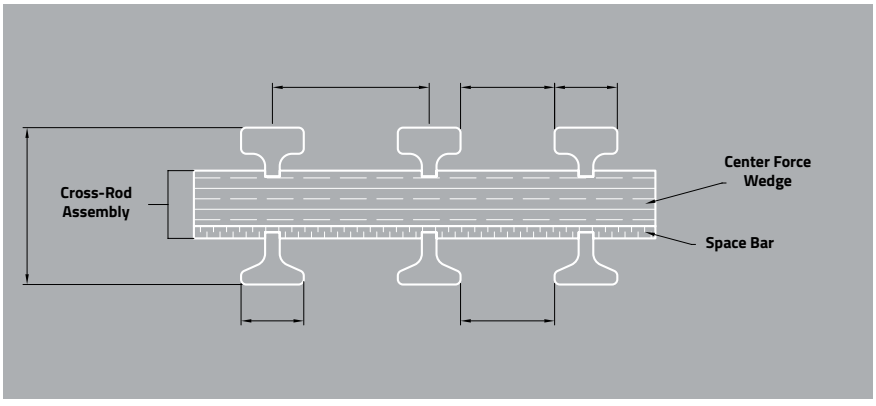


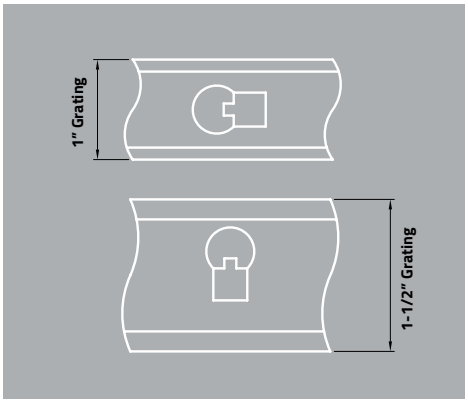
When specifying FRP pultruded grating, ensure the bearing bars for installation will be oriented in the correct direction for the application. Bearing bars shall traverse from support to support. Cross-rods are not intended to be applied in the span direction. The adjacent drawing will help specify the width and length of panels.

Width is the measurement from end to end of the cross-rods. Length is always the bearing bar length.



The 2-piece cross-rod assembly used in pultruded grating forms a strong, unified panel that can be cut and fabricated like a solid panel. This unique system consists of a continuous pultruded spacer bar and a central core wedge. The spacer is notched at each bearing bar so that the bars are both mechanically interlocked and chemically bonded to the web of each bearing bar. This separates and secures the bearing bars and distributes concentrated loads to adjacent bars. The resulting panel can be easily fabricated using standard carpentry tools with tungsten/diamond cutting edges. Ask for the detailed Grating Field Fabrication Guide for more details.

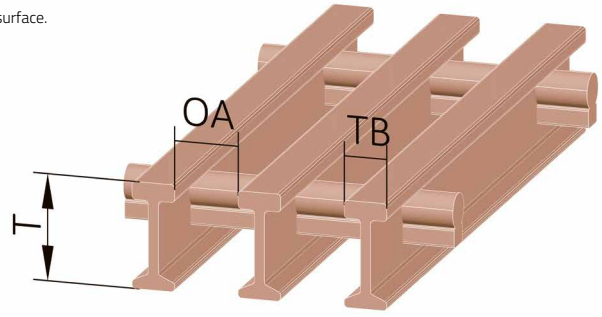


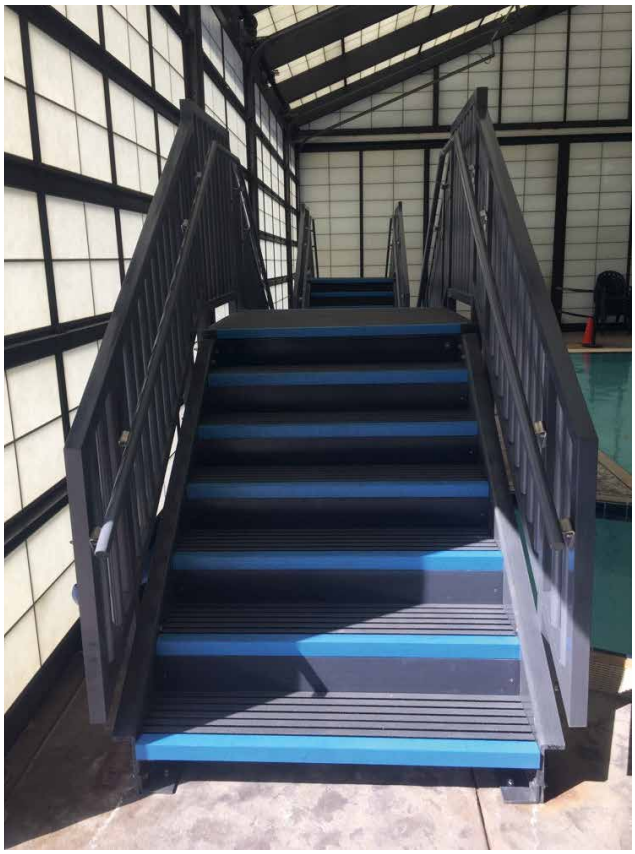


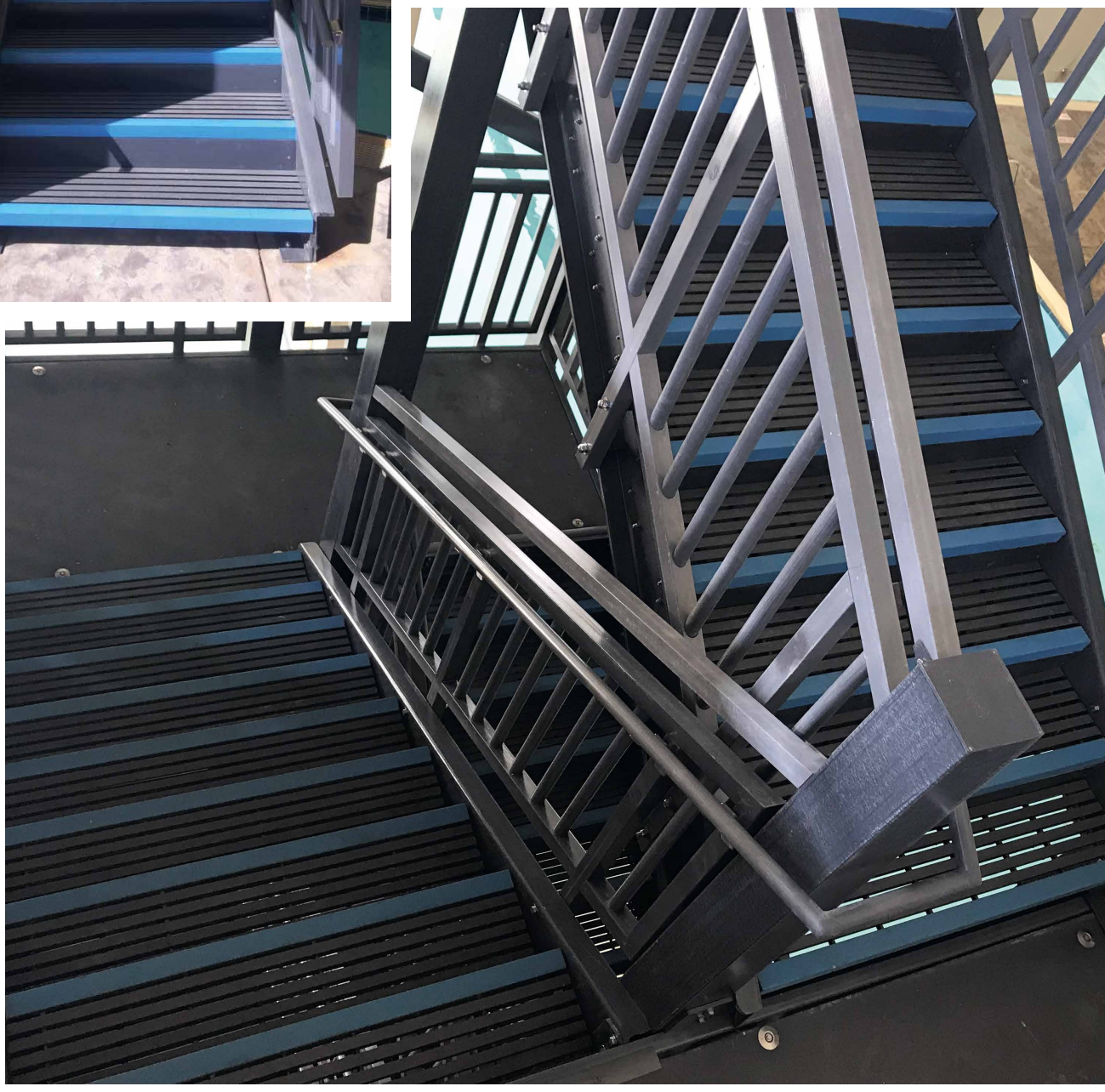
STANDARD TYPES

PULTRUDED GRATING SPECIFICATION							
Series	**Load Bar Type**	**Open Area (OA)**	**Thickness (T)**	**Top Bar Width (TB)**	**Cross Rod Spacing**	**Weight/ Sq.Ft**	**Panel Sizes**
I-4010	I-Bar	40%	1.0"	0.6"	6"	3.83	3' x 20', 4' x 20'
I-5010	I-Bar	50%	1.0"	0.6"	6"	3.25	3' x 20', 4' x 20'
I-6010	I-Bar	60%	1.0"	0.6"	6"	2.68	3' x 20', 4' x 20'
I-4015	I-Bar	40%	1.5"	0.6"	6"	4.92	3' x 20', 4' x 20'
I-5015	I-Bar	50%	1.5"	0.6"	6"	4.16	3' x 20', 4' x 20'
I-6015	I-Bar	60%	1.5"	0.6"	6"	3.40	3' x 20', 4' x 20'
I-4010 ADA	SI-Bar	40%	1.0"	0.3"	6"	4.11	3' x 20', 4' x 20'
I-5010 ADA	SI-Bar	50%	1.0"	0.3"	6"	3.52	3' x 20', 4' x 20'
I-6010 ADA	SI-Bar	60%	1.0"	0.3"	6"	2.95	3' x 20', 4' x 20'
I-4015 ADA	SI-Bar	40%	1.5"	0.3"	6"	5.35	3' x 20', 4' x 20'
I-5015 ADA	SI-Bar	50%	1.5"	0.3"	6"	4.65	3' x 20', 4' x 20'
I-6015 ADA	SI-Bar	60%	1.5"	0.3"	6"	3.75	3' x 20', 4' x 20'
T-1715	T-Bar	17%	1.5"	1.0"	6"	3.51	3' x 20', 4' x 20'
T-3315	T-Bar	33%	1.5"	1.0"	6"	2.97	3' x 20', 4' x 20'
T-5015	T-Bar	50%	1.5"	1.0"	6"	2.43	3' x 20', 4' x 20'
T-1720	T-Bar	17%	2.0"	1.0"	6"	5.00	3' x 20', 4' x 20'
T-3320	T-Bar	33%	2.0"	1.0"	6"	4.18	3' x 20', 4' x 20'
T-5020	T-Bar	50%	2.0"	1.0"	6"	3.38	3' x 20', 4' x 20'
WT-1515	WT-Bar	15%	1.5"	1.5"	6"	3.50	3' x 20', 4' x 20'
WT-2515	WT-Bar	25%	1.5"	1.5"	6"	3.22	3' x 20', 4' x 20'
WT-4015	WT-Bar	40%	1.5"	1.5"	6"	2.61	3' x 20', 4' x 20'
HD-4010	HD-Bar	40%	1.0"	0.6"	6"	6,58	3' x 20', 4' x 20'
HD-5010	HD-Bar	50%	1.0"	0.6"	6"	5,51	3' x 20', 4' x 20'
HD-6010	HD-Bar	60%	1.0"	0.6"	6"	4,45	3' x 20', 4' x 20'
HD-4015	HD-Bar	40%	1.5"	0.6"	6"	9.87	3' x 20', 4' x 20'
HD-5015	HD-Bar	50%	1.5"	0.6"	6"	8.27	3' x 20', 4' x 20'
HD-6015	HD-Bar	60%	1.5"	0.6"	6"	6.67	3' x 20', 4' x 20'

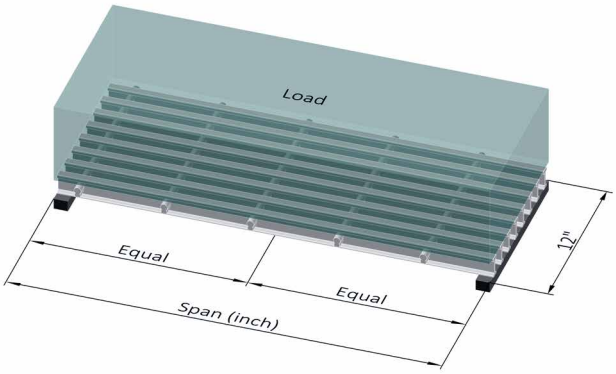
Notes:
1. Panel weight may vary according to type of resin used and top surface.
2. Other thicknesses and sizes are available upon request.







UNIFORM LOAD



Notes:

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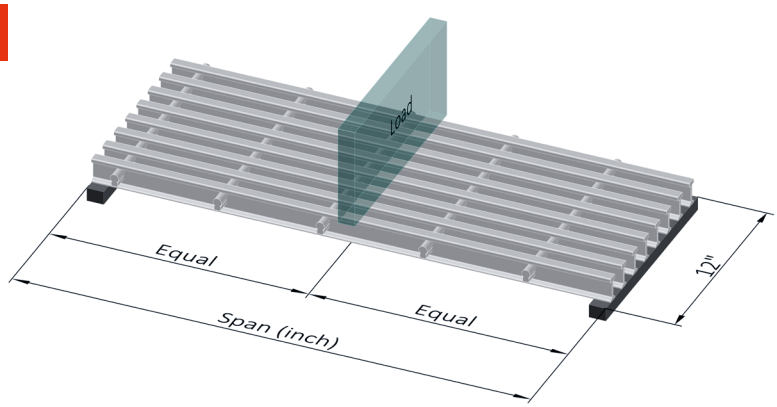
- The designer should not exceed MAXIMUM RECOMMENDED load at any time. MAXIMUM LOAD represents a 2:1 factor of safety on ULTIMATE CAPACITY. ULTIMATE CAPACITY represents MAX LOAD observed at initial fracture.
- A 50-60 PSF live load is recommended for walkways per ASCE 7. Deflection is typically limited to a ¼" or SPAN divided by 200 under full live load.
- The allowable loads are for static load conditions at standard temperature 73°F +- 3.6°F (23°C +- 2°C).
- For applications involving dynamic loads, long-term loads that result in creep, or elevated temperature, consult Lichtgitter.
- For rectangular mesh grating the load bars need to be oriented in the SPAN direction.
- Grating support shall be >1" (25mm), gratings minimum length shall be >12" (305mm)

LOAD IN LB/SQUARE FOOT (PSF)										
span in inches	**typ**	**60**	**100**	**150**	**200**	**250**	**500**	**1000**	**2000**	**maximum recommened load (psf)**
12	I-4010	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.03	12.000
	I-5010	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.03	10.000
	I-6010	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.05	8.000
	I-4015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	18.400
	I-5015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	15.335
	I-6015	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.02	12.270
	T-3320	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	20.030
	T-5020	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	15.020
	HD-4015									
	HD-5015									
	HD-6015									
18	I-4010	<0.01	<0.01	0.01	0.01	0.02	0.03	0.06	0.13	6.700
	I-5010	<0.01	<0.01	0.01	0.01	0.02	0.04	0.07	0.14	5.575
	I-6010	<0.01	<0.01	0.01	0.02	0.02	0.05	0.09	0.19	4.470
	I-4015	<0.01	<0.01	<0.01	0.01	0.01	0.01	0.03	0.05	9.200
	I-5015	<0.01	<0.01	0.01	0.01	0.01	0.02	0.03	0.07	7.665
	I-6015	<0.01	<0.01	0.01	0.01	0.01	0.02	0.04	0.08	6.130
	T-3320	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.04	11.110
	T-5020	<0.01	<0.01	<0.01	0.01	0.01	0.01	0.03	0.06	8.330
	HD-4015	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.03	18.350
	HD-5015	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.04	15.630
	HD-6015	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.04	12.500

LOAD IN LB/SQUARE FOOT (PSF)										
span in inches	**typ**	**60**	**100**	**150**	**200**	**250**	**500**	**1000**	**2000**	**maximum recommened load (psf)**
	I-4010	0.01	0.02	0.03	0.03	0.04	0.09	0.17		4.200
	I-5010	0.01	0.02	0.03	0.04	0.05	0.10	0.20		3.500
	I-6010	0.01	0.03	0.04	0.05	0.07	0.13			2.800
	I-4015	<0.01	0.01	0.01	0.01	0.02	0.03	0.07	0.14	5.250
	I-5015	0.01	0.01	0.01	0.02	0.02	0.04	0.08	0.19	4.375
24	I-6015	0.01	0.01	0.02	0.02	0.03	0.05	0.10	0.21	3.500
	T-3320	<0.01	<0.01	0.01	0.01	0.01	0.03	0.05	0.10	7.130
	T-5020	<0.01	0.01	0.01	0.01	0.02	0.03	0.07	0.14	5.350
	HD-4015	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.04	0.08	14.725
	HD-5015	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.04	0.08	11.720
	HD-6015	<0.01	<0.01	<0.01	0.01	0.02	0.03	0.05	0.11	9.380
	I-4010	0.02	0.04	0.06	0.08	0.10	0.20			2.820
	I-5010	0.02	0.05	0.07	0.09	0.11	0.22			2.350
	I-6010	0.03	0.06	0.09	0.12	0.15				1.880
	I-4015	0.01	0.02	0.02	0.03	0.04	0.08	0.15		3.480
	I-5015	0.01	0.02	0.03	0.03	0.04	0.08	0.18		2.900
30	I-6015	0.01	0.02	0.03	0.05	0.06	0.12	0.23		2.320
	T-3320	0.01	0.01	0.02	0.02	0.03	0.05	0.11	0.21	4.880
	T-5020	0.01	0.01	0.02	0.03	0.04	0.07	0.14	0.28	3.660
	HD-4015	<0.01	0.01	0.01	0.02	0.02	0.04	0.08	0.17	11.808
	HD-5015	<0.01	0.01	0.02	0.03	0.04	0.05	0.10	0.20	9.380
	HD-6015	<0.01	0.01	0.02	0.03	0.04	0.06	0.12	0.25	7.500
	I-4010	0.05	0.08	0.12	0.16	0.20				2.020
	I-5010	0.05	0.09	0.14	0.18	0.23				1.590
	I-6010	0.07	0.12	0.18	0.24	0.31				1.350
	I-4015	0.02	0.03	0.05	0.06	0.08	0.15	0.30		2.480
	I-5015	0.02	0.03	0.05	0.07	0.08	0.17	0.34		2.065
36	I-6015	0.02	0.05	0.07	0.09	0.11	0.23			1.650
	T-3320	0.01	0.02	0.03	0.04	0.05	0.11	0.21		3.420
	T-5020	0.01	0.03	0.04	0.06	0.07	0.14	0.28		2.570
	HD-4015	0.01	0.02	0.03	0.04	0.04	0.09	0.17	0.36	8.325
	HD-5015	0.01	0.02	0.03	0.04	0.05	0.10	0.19	0.38	6.510
	HD-6015	0.01	0.03	0.04	0.05	0.06	0.12	0.24	0.49	5.210
	I-4010	0.08	0.15	0.22	0.29	0.37				1.410
	I-5010	0.08	0.17	0.25	0.33	0.42				1.175
	I-6010	0.13	0.22	0.33	0.44					940
	I-4015	0.03	0.06	0.08	0.11	0.14	0.18			1.840
	I-5015	0.03	0.06	0.09	0.12	0.15	0.35			1.530
42	I-6015	0.05	0.08	0.12	0.17	0.21	0.41			1.220
	T-3320	0.02	0.04	0.06	0.07	0.09	0.19	0.37		2.480
	T-5020	0.02	0.05	0.07	0.10	0.12	0.25			1.860
	HD-4015	0.02	0.03	0.04	0.07	0.07	0.15	0.29	0.59	6.021
	HD-5015	0.02	0.04	0.06	0.07	0.08	0.17	0.38	0.69	4.780
	HD-6015	0.02	0.05	0.07	0.09	0.10	0.22	0.48		3.820
	I-4010	0.14	0.25	0.37						1.070
	I-5010	0.14	0.28	0.42						890
	I-6010	0.23	0.37							710
	I-4015	0.06	0.09	0.14	0.19	0.23	0.47			1.330
	I-5015	0.06	0.10	0.16	0.21	0.26				1.110
48	I-6015	0.08	0.14	0.21	0.28	0.35				890
	T-3320	0.03	0.06	0.09	0.12	0.16	0.31			1.520
	T-5020	0.05	0.08	0.12	0.17	0.21	0.41			1.140
	HD-4015	0.03	0.05	0.07	0.10	0.11	0.25	0.48		4.642
	HD-5015	0.03	0.06	0.09	0.12	0.13	0.29	0.69		3.660
	HD-6015	0.04	0.08	0.11	0.16	0.17	0.37			2.930

LOAD IN LB/SQUARE FOOT (PSF)										
span in inches	**typ**	**60**	**100**	**150**	**200**	**250**	**500**	**1000**	**2000**	**maximum recommened load (psf)**
54	I-4010	0.24	0.40							730
	I-5010	0.25	0.45							610
	I-6010	0.43								490
	I-4015	0.08	0.15	0.22	0.30	0.37				990
	I-5015	0.08	0.16	0.27	0.33	0.42				825
	I-6015	0.13	0.22	0.34	0.45					660
	T-3320	0.06	0.10	0.15	0.19	0.24	0.48			1.380
	T-5020	0.07	0.13	0.19	0.26	0.32				1.040
	HD-4015	0.04	0.08	0.13	0.15	0.17	0.39			3.628
	HD-5015	0.05	0.10	0.14	0.19	0.24	0.46			2.890
	HD-6015	0.06	0.12	0.18	0.23	0.26	0.58			2.310
60	I-4015	0.13	0.23	0.34	0.46					750
	I-5015	0.13	0.25	0.37						625
	I-6015	0.20	0.34							500
	T-3320	0.08	0.15	0.22	0.29	0.37				1.070
	T-5020	0.12	0.20	0.29	0.39	0.49				800
	HD-4015	0.06	0.12	0.17	0.23	0.26	0.58			2.941
	HD-5015	0.07	0.14	0.22	0.28	0.31	0.68			2.340
	HD-6015	0.09	0.18	0.26	0.36	0.40				1.870
66	I-4015	0.20	0.33	0.50						570
	I-5015	0.20	0.37							475
	I-6015	0.30	0.50							380
	T-3320	0.13	0.21	0.32	0.43					850
	T-5020	0.17	0.29	0.43						640
	HD-4015	0.08	0.17	0.26	0.33	0.38				2.452
	HD-5015	0.10	0.20	0.30	0.40	0.46				1.930
	HD-6015	0.13	0.26	0.38	0.54	0.59				1.550
72	T-3320	0.18	0.30	0.45						680
	T-5020	0.24	0.40							510
	HD-4015	0.12	0.24	0.35	0.47	0.53				2.040
	HD-5015	0.15	0.29	0.44	0.58					1.620
	HD-6015	0.18	0.36	0.55	0.73					1.300

CONCENTRATED LOAD



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- The allowable loads are for static load conditions at standard temperature 73°F +- 3.6°F (23°C +- 2°C).
- For applications involving dynamic loads, long-term loads that result in creep, or elevated temperature, consult Lichtgitter.
- For rectangular mesh grating the load bars need to be oriented in the SPAN direction.
- Grating support shall be >1" (25mm), gratings minimum length shall be >12" (305mm)
- Loading area for line load: 1" (25mm) wide x 12" (305mm) long (see sketch)

LOAD IN LB/FOOT OF WIDTH

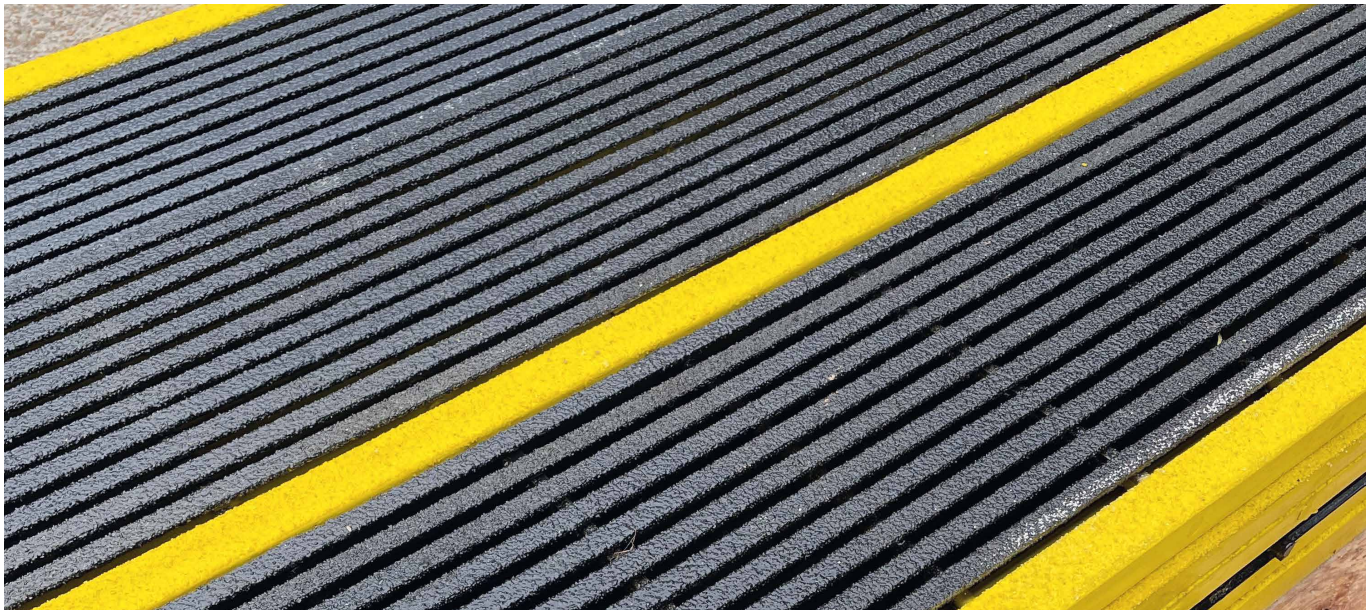
span in inches	typ	50	100	150	200	250	500	1000	2000	maximum recommened load (lb/ft)
12	I-4010	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.03	0.05	6.000
	I-5010	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.03	0.06	5.000
	I-6010	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.04	0.08	4.000
	I-4015	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.01	0.03	9.200
	I-5015	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.03	7.665
	I-6015	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.04	6.130
	T-3320	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	10.010
	T-5020	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.03	7.510
	HD-4015									
	HD-5015									
	HD-6015									
18	I-4010	<0.01	0.01	0.01	0.01	0.02	0.03	0.07	0.14	5.030
	I-5010	<0.01	0.01	0.01	0.02	0.02	0.04	0.07	0.15	4.190
	I-6010	<0.01	0.01	0.02	0.02	0.03	0.05	0.10		3.350
	I-4015	<0.01	<0.01	<0.01	0.01	0.01	0.01	0.03	0.06	6.900
	I-5015	<0.01	<0.01	0.01	0.01	0.01	0.02	0.03	0.07	5.750
	I-6015	<0.01	<0.01	0.01	0.01	0.01	0.02	0.04	0.08	4.600
	T-3320	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.04	8.330
	T-5020	<0.01	<0.01	<0.01	0.01	0.01	0.01	0.03	0.06	6.250
	HD-4015	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.03	15.110
	HD-5015	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.04	14.510
	HD-6015	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.05	11.810

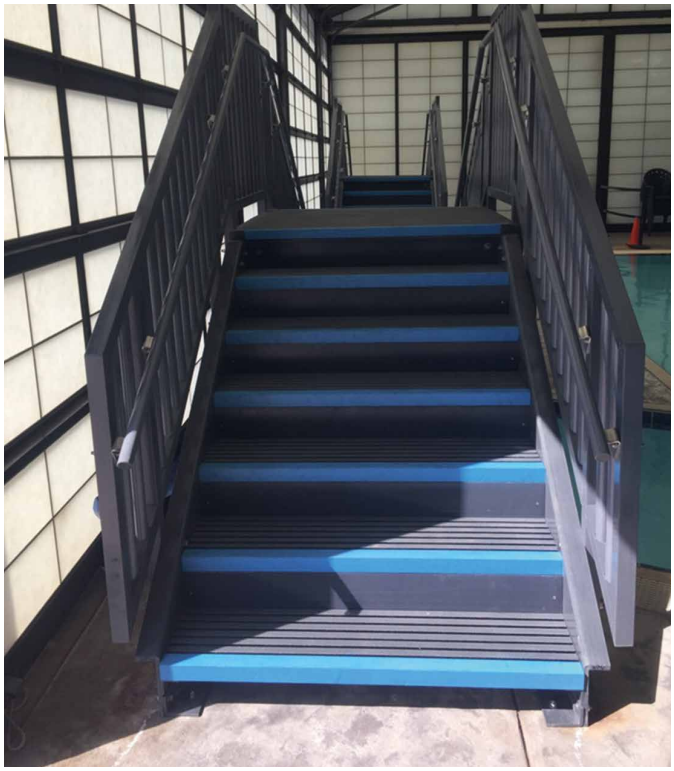
LOAD IN LB/FOOT OF WIDTH										
span in inches	**typ**	**50**	**100**	**150**	**200**	**250**	**500**	**1000**	**2000**	**maximum recommened load (lb/ft)**
	I-4010	<0.01	0.01	0.02	0.03	0.03	0.07	0.14		4.200
	I-5010	0.01	0.02	0.02	0.03	0.04	0.08	0.15		3.500
	I-6010	0.01	0.02	0.03	0.04	0.05	0.10	0.21		2.800
	I-4015	<0.01	<0.01	0.01	0.01	0.01	0.03	0.06	0.11	5.250
	I-5015	<0.01	<0.01	0.01	0.02	0.02	0.03	0.06	0.12	4.375
24	I-6015	<0.01	0.01	0.01	0.02	0.02	0.04	0.08	0.17	3.500
	T-3320	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.04	0.08	7.130
	T-5020	<0.01	<0.01	0.01	0.01	0.01	0.03	0.05	0.11	5.350
	HD-4015	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.03	0.06	12.480
	HD-5015	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.03	0.07	10.880
	HD-6015	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.04	0.08	8.860
	I-4010	0.01	0.03	0.04	0.05	0.06	0.13	0.26		3.530
	I-5010	0.02	0.03	0.04	0.06	0.07	0.14	0.28		2.940
	I-6010	0.02	0.04	0.06	0.08	0.10	0.19	0.39		2.350
	I-4015	<0.01	0.01	0.01	0.02	0.02	0.05	0.10	0.20	4.350
	I-5015	<0.01	0.01	0.01	0.03	0.03	0.06	0.11	0.22	3.625
30	I-6015	0.01	0.01	0.02	0.03	0.04	0.07	0.15	0.30	2.900
	T-3320	<0.01	<0.01	0.01	0.01	0.02	0.03	0.07	0.14	6.090
	T-5020	<0.01	0.01	0.01	0.02	0.02	0.05	0.09	0.18	4.570
	HD-4015	<0.01	<0.01	0.01	0.01	0.01	0.03	0.05	0.11	10.270
	HD-5015	<0.01	<0.01	0.01	0.01	0.02	0.03	0.06	0.12	8.710
	HD-6015	<0.01	<0.01	0.01	0.01	0.02	0.04	0.08	0.16	7.080
	I-4010	0.02	0.04	0.07	0.09	0.11	0.22			3.040
	I-5010	0.03	0.05	0.07	0.10	0.12	0.24			2.530
	I-6010	0.03	0.07	0.10	0.13	0.16	0.33			2.020
	I-4015	0.01	0.02	0.02	0.03	0.04	0.08	0.16	0.32	3.710
	I-5015	0.01	0.02	0.02	0.04	0.05	0.09	0.19	0.36	3.095
36	I-6015	0.01	0.02	0.04	0.05	0.06	0.12	0.24		2.480
	T-3320	0.01	0.01	0.02	0.02	0.03	0.06	0.11	0.22	5.130
	T-5020	0.01	0.01	0.02	0.03	0.04	0.07	0.15	0.30	3.850
	HD-4015	<0.01	0.01	0.01	0.02	0.02	0.04	0.09	0.18	8.555
	HD-5015	<0.01	0.01	0.02	0.02	0.03	0.05	0.12	0.20	7.250
	HD-6015	<0.01	0.02	0.02	0.03	0.04	0.06	0.14	0.27	5.900
	I-4010	0.03	0.07	0.10	0.13	0.17	0.34			2.480
	I-5010	0.04	0.08	0.11	0.15	0.19	0.38			2.065
	I-6010	0.05	0.10	0.15	0.20	0.25				1.650
	I-4015	0.01	0.03	0.04	0.05	0.06	0.13	0.25		3.220
	I-5015	0.01	0.03	0.04	0.06	0.09	0.14	0.29		2.680
42	I-6015	0.02	0.04	0.06	0.08	0.09	0.19	0.38		2.140
	T-3320	0.01	0.02	0.03	0.03	0.04	0.09	0.11	0.34	4.330
	T-5020	0.01	0.02	0.03	0.05	0.06	0.11	0.23		3.250
	HD-4015	<0.01	0.01	0.02	0.03	0.03	0.07	0.13	0.26	7.320
	HD-5015	<0.01	0.02	0.03	0.04	0.05	0.09	0.15	0.32	6.210
	HD-6015	<0.01	0.02	0.03	0.04	0.05	0.10	0.20	0.41	5.030

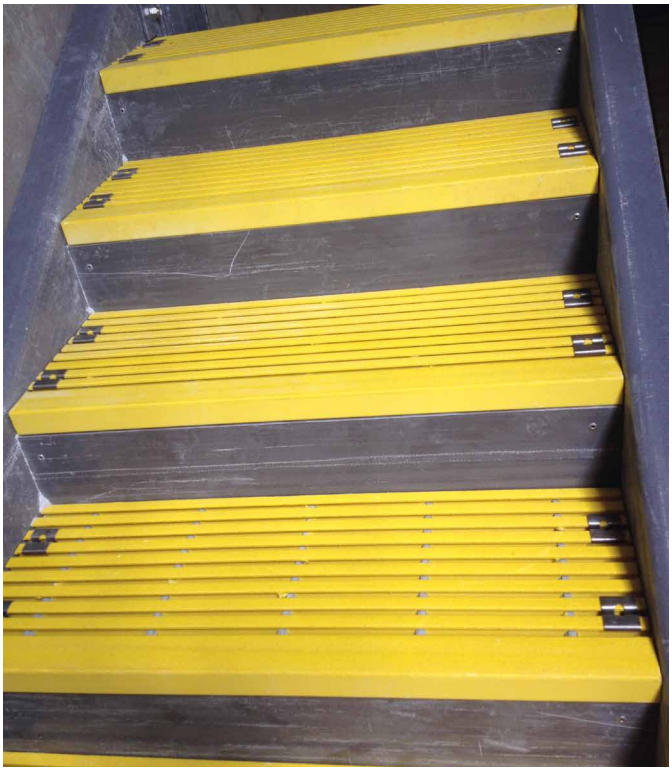
LOAD IN LB/SQUARE FOOT (PSF)										
span in inches	**typ**	**60**	**100**	**150**	**200**	**250**	**500**	**1000**	**2000**	**maximum recommened load (psf)**
48	I-4010	0.05	0.10	0.15	0.20	0.25	0.50			2.140
	I-5010	0.06	0.11	0.17	0.23	0.28				1.780
	I-6010	0.07	0.15	0.22	0.30	0.37				1.420
	I-4015	0.02	0.04	0.06	0.07	0.09	0.19	0.37		2.660
	I-5015	0.02	0.04	0.06	0.08	0.11	0.21			2.220
	I-6015	0.03	0.06	0.08	0.11	0.14	0.28			1.780
	T-3320	0.01	0.02	0.04	0.05	0.06	0.12	0.25		3.030
	T-5020	0.02	0.03	0.05	0.07	0.08	0.17	0.33		2.280
	HD-4015	0.01	0.02	0.03	0.04	0.05	0.10	0.19	0.38	6.420
	HD-5015	0.01	0.02	0.04	0.05	0.07	0.15	0.23	0.46	5.420
	HD-6015	0.02	0.03	0.05	0.06	0.07	0.16	0.29	0.59	4.430
54	I-4010	0.07	0.14	0.21	0.28	0.35				1.650
	I-5010	0.08	0.16	0.24	0.32	0.40				1.375
	I-6010	0.11	0.21	0.32	0.42					1.100
	I-4015	0.03	0.05	0.08	0.11	0.13	0.27			2.220
	I-5015	0.03	0.06	0.08	0.12	0.18	0.29			1.850
	I-6015	0.04	0.08	0.12	0.16	0.20	0.40			1.480
	T-3320	0.02	0.03	0.05	0.07	0.09	0.17	0.34		3.110
	T-5020	0.02	0.05	0.07	0.09	0.11	0.23	0.46		2.340
	HD-4015	0.01	0.03	0.04	0.06	0.07	0.14	0.28	0.56	5.710
	HD-5015	0.02	0.03	0.05	0.07	0.08	0.16	0.35	0.69	4.780
	HD-6015	0.02	0.04	0.06	0.08	0.10	0.25	0.41		3.930
60	I-4015	0.04	0.07	0.11	0.15	0.17	0.36			1.890
	I-5015	0.04	0.08	0.12	0.17	0.22				1.575
	I-6015	0.05	0.11	0.16	0.22					1.260
	T-3320	0.02	0.05	0.07	0.09	0.12	0.23	0.47		2.670
	T-5020	0.03	0.06	0.09	0.13	0.16	0.31			2.000
	HD-4015	0.02	0.04	0.06	0.07	0.08	0.18	0.36		5.135
	HD-5015	0.02	0.05	0.07	0.09	0.12	0.29	0.49		4.350
	HD-6015	0.03	0.06	0.09	0.12	0.13	0.29	0.55		3.540
66	I-4015	0.05	0.10	0.15	0.19	0.24	0.48			1.580
	I-5015	0.05	0.11	0.16	0.23	0.30				1.315
	I-6015	0.07	0.15	0.22	0.29					1.050
	T-3320	0.03	0.06	0.09	0.12	0.16	0.31			2.330
	T-5020	0.04	0.08	0.12	0.17	0.21	0.42			1.750
	HD-4015	0.02	0.05	0.07	0.10	0.11	0.24	0.48		4.624
	HD-5015	0.03	0.06	0.09	0.12	0.14	0.29	0.58		3.950
	HD-6015	0.04	0.07	0.11	0.15	0.17	0.37			3.220
72	T-3320	0.04	0.08	0.12	0.16	0.20	0.40			2.060
	T-5020	0.05	0.11	0.16	0.22	0.27				1.540
	HD-4015	0.03	0.06	0.10	0.14	0.15	0.31	0.62		4.231
	HD-5015	0.04	0.08	0.13	0.15	0.18	0.39			3.590
	HD-6015	0.05	0.10	0.15	0.19	0.22	0.48			2.930

PULTRUDED STAIRTREADS

Lichtgitter pultruded FRP stair treads provide the same level of slip resistance, non-conductivity, strength and corrosion resistance as other pultruded FRP products. They are supplied with a pultruded tube nosing. The nosing has a grit surface to ensure optimum slip resistance. Lichtgitter supplies pultruded FRP stair treads in 1'x12' with a 1-1/2" depth and 60% open space as standard. Other sizes and types are available upon request. We also offer several types of fastening solutions to ensure effective installation.

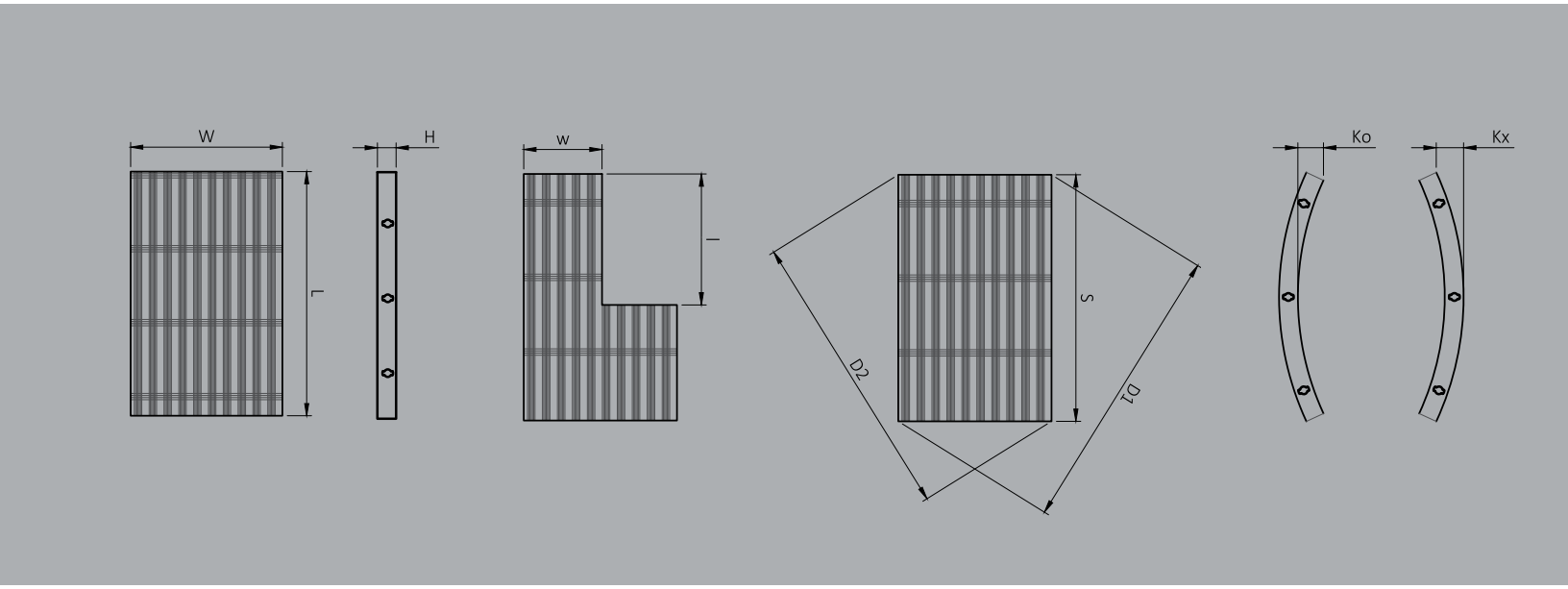






TOLERANCES OF FRP GRATINGS

Lichtgitter FRP gratings are subject to fixed production and delivery tolerances.



Length deviations and width deviations
W = max. + 1/25" / - 1/4"; L = max. + 7/25" / - 1/6"

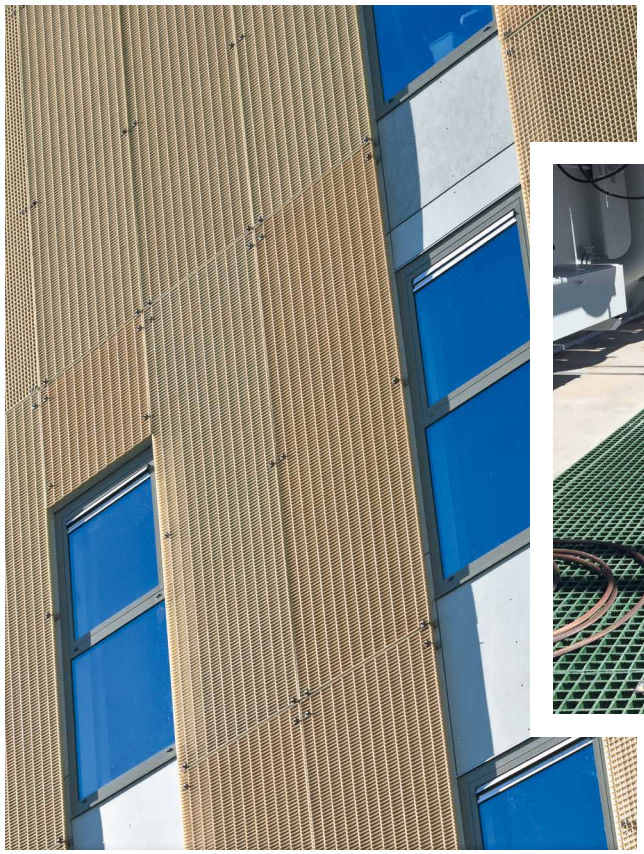
Height deviations
H = max. + 1/25" / - 1/25"

Sections:
w; l = max. + 1/6" / - 1/25"

Diagonal deviation
Difference of measured diagonals D1 minus D2 max. 1/4"

Evenness:
Deviation for convex (Kx) in length and width: max. 1/4"
Deviation for concave (Ko) in length and width: max. 1/12"

Note: Single-sided closed FRP gratings may be subject to increased warping.



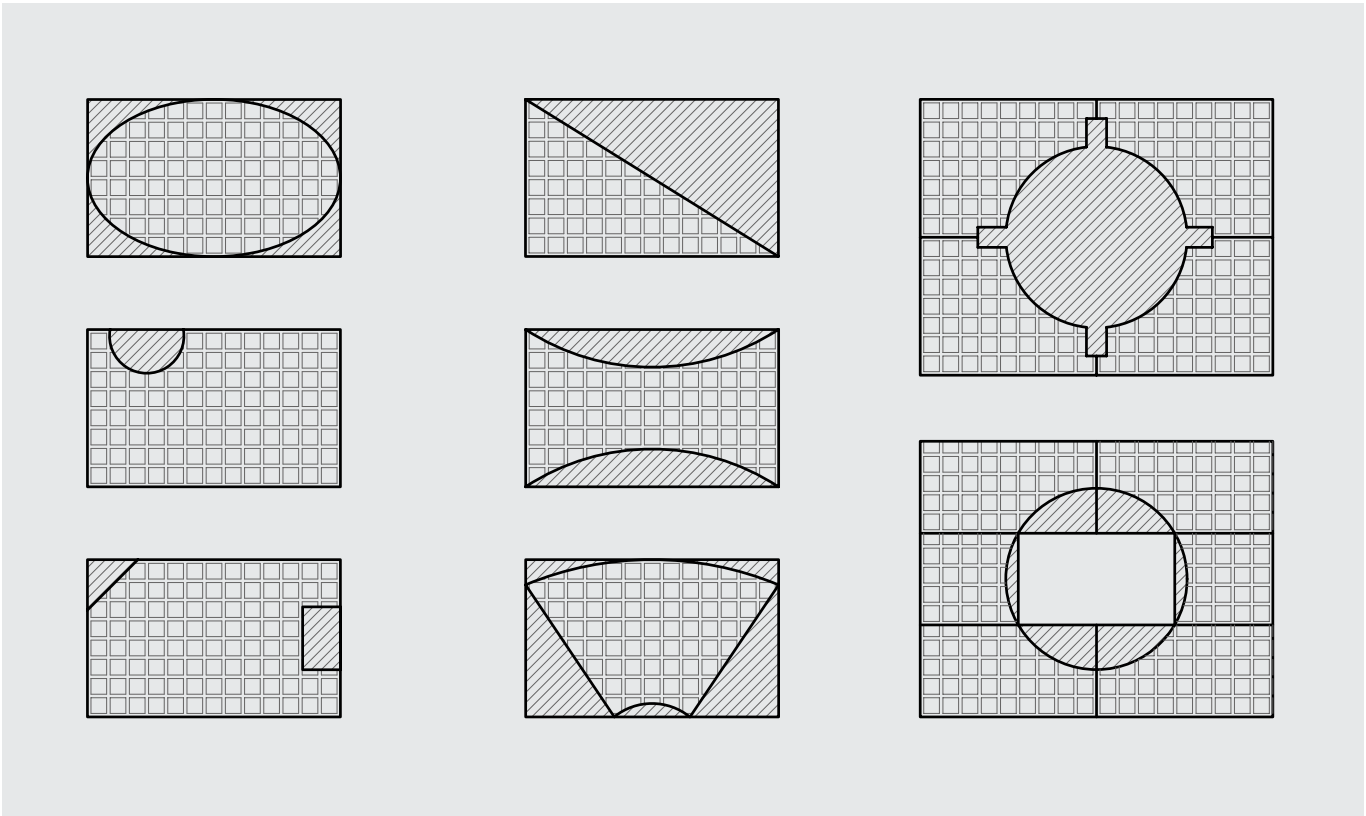
FRP GRATING PRICING

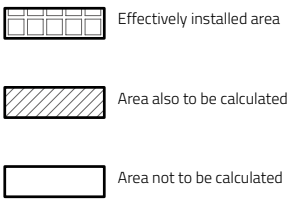
The area to be produced corresponding to the smallest rectangle or square which encompasses the grating is priced in square feet according to the smallest rectangle or square which encompasses the grating.

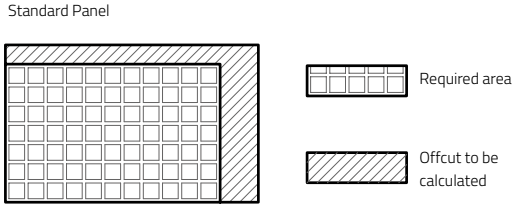
The dimensions of cut-outs and sections for openings, collar components and adjustments are calculated in the same way as the area to be produced of an individual grating.

Small individual cuts are priced into the lump sump. Additional services such as attaching toe plates, notches, nosings, non-standard surfaces, fixings, coloring are priced separately per unit.

FRP gratings etc. are priced at the unit prices agreed. The lists of items (order confirmations), layout plans and/or the local survey form the basis for pricing.







Other special pricing procedures for FRP gratings. For our products made from sheet material, cuttings are priced per square feet and straight cuts per feet.

EVERYTHING FROM ONE SOURCE:

FORGE-WELDED GRATINGS, PRESSURE-LOCKED GRATINGS, PERFORATED METAL PLANKS, FRP-GRATINGS, CHECKER PLATES, SPIRAL STAIRCASES, STAIRTREADS, LADDER RUNGS, HOT-DIP GALVANIZING, STEEL SERVICE.

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Version: 01