FRP HANDRAIL SYSTEMS
MM09
06.05.2020 Rev. 4

FRP HANDRAIL SYSTEMS

COMPOSITE SOLUTION

SUMMARY

1. USE AND CHARACTERISTICS

The FRP handrail systems are built by assembling fiberglass and polyester resin profiles, they assure several advantages compared to the normal metal ones:

a. High resistance to chemical and atmospheric aggressions
b. High mechanical/weight ratio
c. Long-lasting
d. Lightness
e. Dimensional stability
f. High dielectric properties
g. No maintenance
h. Easy to install

Handrail systems are designed and built accordingly to the **UNI EN ISO 14122-3** norm.

2. APPLICATIONS

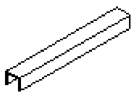
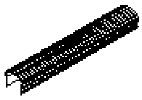
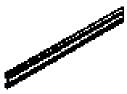
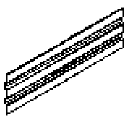
MM's HANDRAIL SYSTEMS can be installed in any plant, but they are mainly used in **corrosive environments** where their characteristics are emphasized, as in those plants where conventional materials are not long lasting or need continuous varnishing or protection with high maintenance costs and even so, the working environment may in any case not be completely safe.

The industries that use MM's PARAPETS are:

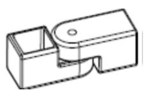
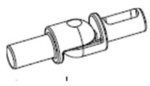
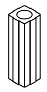
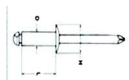
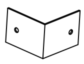
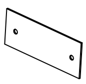
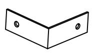
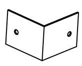
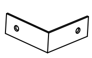
- **Chemical industries**
- **Galvanic plants**
- **Mineral industries**
- **Textile industries**
- **Food industries**
- **Electric stations**
- **Electric distribution cabins**
- **Oil plants**
- **Tanneries**
- **Water treatment plants**
- **Marine field**
- **Paper factories**

3. MATERIALS

3.1 PROFILES

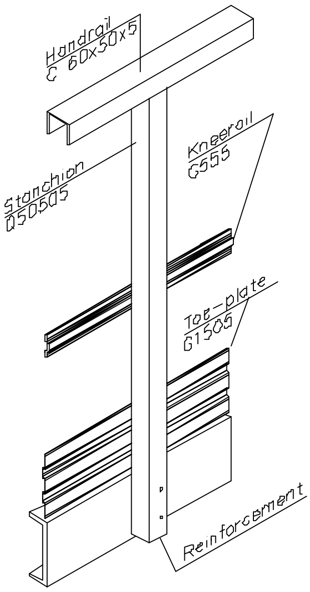
HORIZONTAL PROFILES						
PROFILE	**CODE**	**DESCRIPTION**	**DIMENSIONS (mm)**	**BAR LENGTH (m)**	**WEIGHT (Kg/m)**	**COLOR**
	53C60505I	Handrail	60x50x5	6	1.27	Yellow/Grey
	53C60605I	Ergonomic handrail	60x60x5	6	1.24	Yellow/Grey
	53G555I	Kneerail	shaped 55x5	6	0.5	Yellow/Grey
	5302619I	Tubular kneerail	Ø 26x19	6	0.5	Yellow/Grey
	53G1505I	Toe-plate	shaped 150x5	6	1.35	Yellow/Grey
VERTICAL PROFILES						
PROFILE	**CODE**	**DESCRIPTION**	**DIMENSIONS (mm)**	**BAR LENGTH (m)**	**WEIGHT (Kg/m)**	**COLOR**
	53Q50505I	Stanchion POST01	square 50x50x5	1.10	1.53	Yellow/Grey
	53Q50505I	Stanchion POERG01 with ø 26 mm hole	square 50x50x5	1.10	1.53	Yellow/Grey
	53Q50505I	Stanchion PVST01	square 50x50x5	1.33	1.53	Yellow/Grey
	53Q50505I	Stanchion PVERG01 with ø 26 mm hole	square 50x50x5	1.33	1.53	Yellow/Grey
	53Q50505I	STANDARD Stanchion	square 50x50x5	6.00	1.53	Yellow/Grey

3.2 ACCESSORIES FOR FIXING AND JOINTS

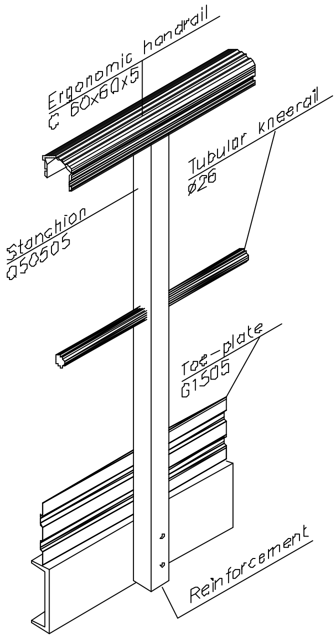
ACCESSORY	CODE	DESCRIPTION	COLOR
	58PA66SCE17035	Adjustable handrail junction in recycled plastic Specific for angle junctions different form 90°	Yellow/Grey
	58PA66STI17035	Adjustable tubular kneerail junction in recycled plastic Specific for angle junctions different form 90°	Yellow/Grey
	58PA66IFPQ50505	Reinforcement for vertical fixing stanchion	Black
	58PA66TCE17035	Ergonomic handrail cap	Yellow/Grey
	58PA66TTI17035	Tubular kneerail 26x19 cap	Yellow/Grey
	57RIVCUNI416	Stainless Steel rivets 4x12 mm	-
	56ASTAFFA8	Stainless Steel AISI 304 stanchion base plate	-
	56A40404012	90° handrail junction Stainless Steel angle type L40x40x40 thickness 1.2 mm	-
	56P501512	Linear junction for toe-plate Stainless Steel plate 50x15 thickness 1.2 mm	-
	56A40401512	90° toe-plate junction Stainless Steel angle type L40x40x15 thickness 1.2 mm	-
	56A40404012	variable angle junction for handrail Stainless Steel angle type L40x40x40 thickness 1.2 mm	-
	56A40401512	variable angle junction for shaped profile Stainless Steel angle type L40x40x15 thickness 1.2 mm	-
	53Q50505I	Linear junction for ergonomic handrail 100mm long square Q50x50x5mm	Yellow/Grey

4. TYPES

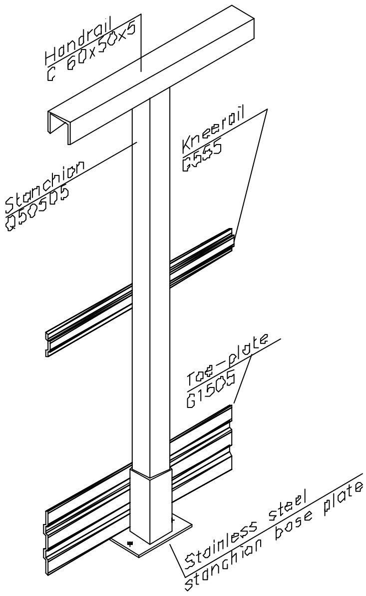
MM's standard parapets have been studied and built according to the **UNI EN ISO 14122-3** norm.



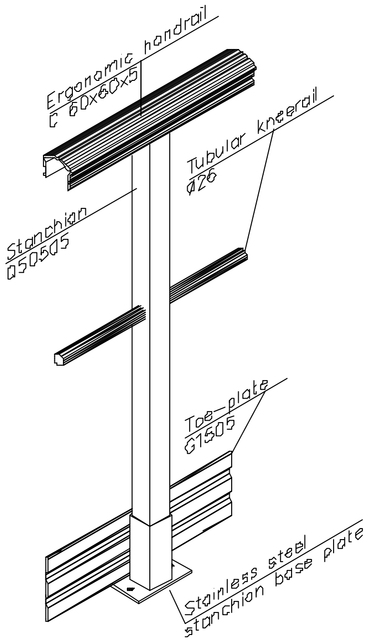
PVST01
Handrail system with lateral
fixing STANDARD type



PVERG01
Handrail system with lateral
fixing ERGONOMIC type

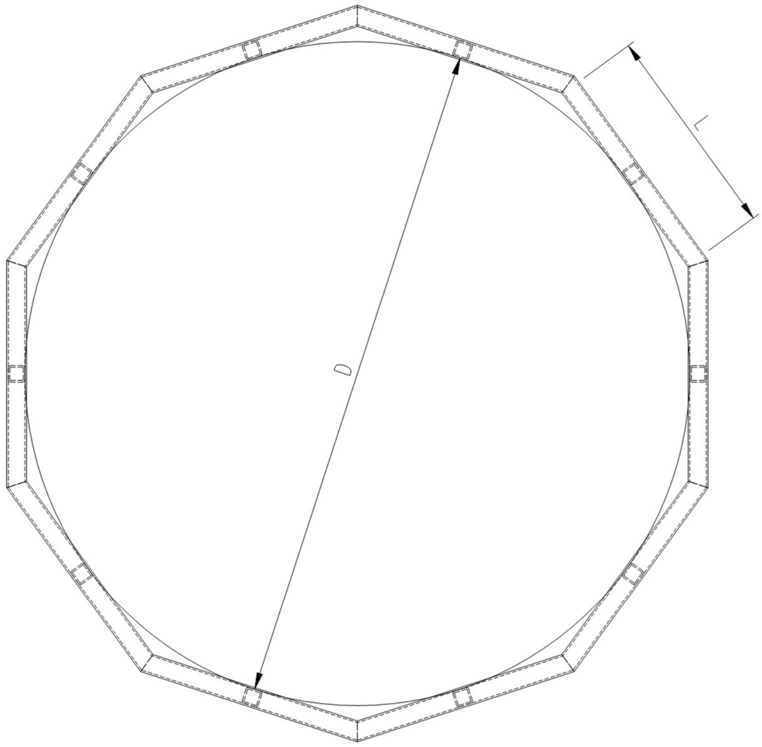


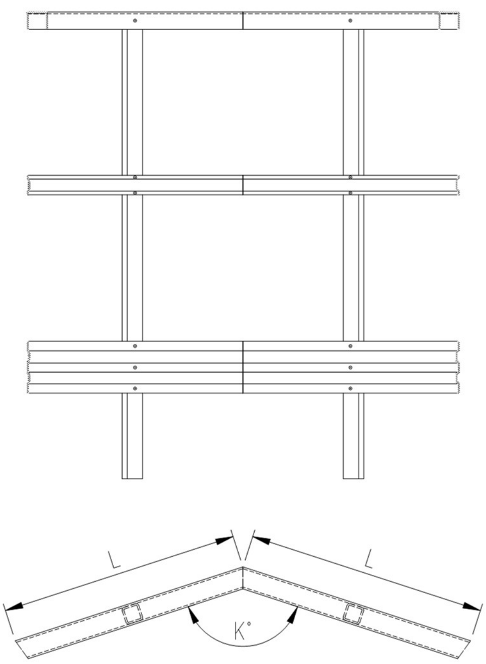
POST01
Handrail system with horizontal
fixing STANDARD type



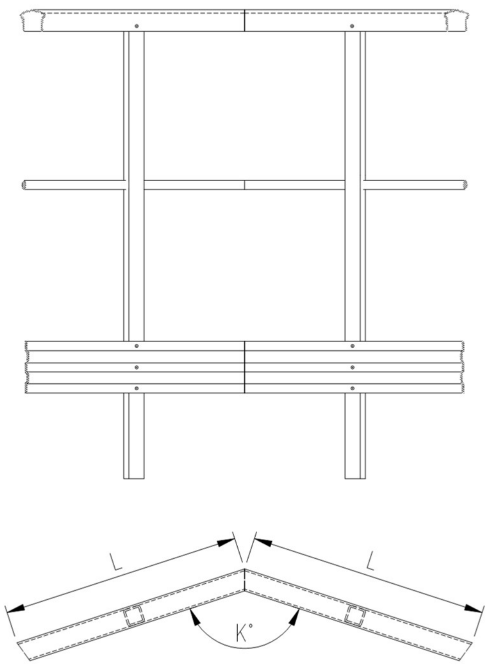
POERG01
Handrail system with horizontal
fixing ERGONOMIC type

ROUND HANDRAIL SYSTEM WITH LATERAL FIXING





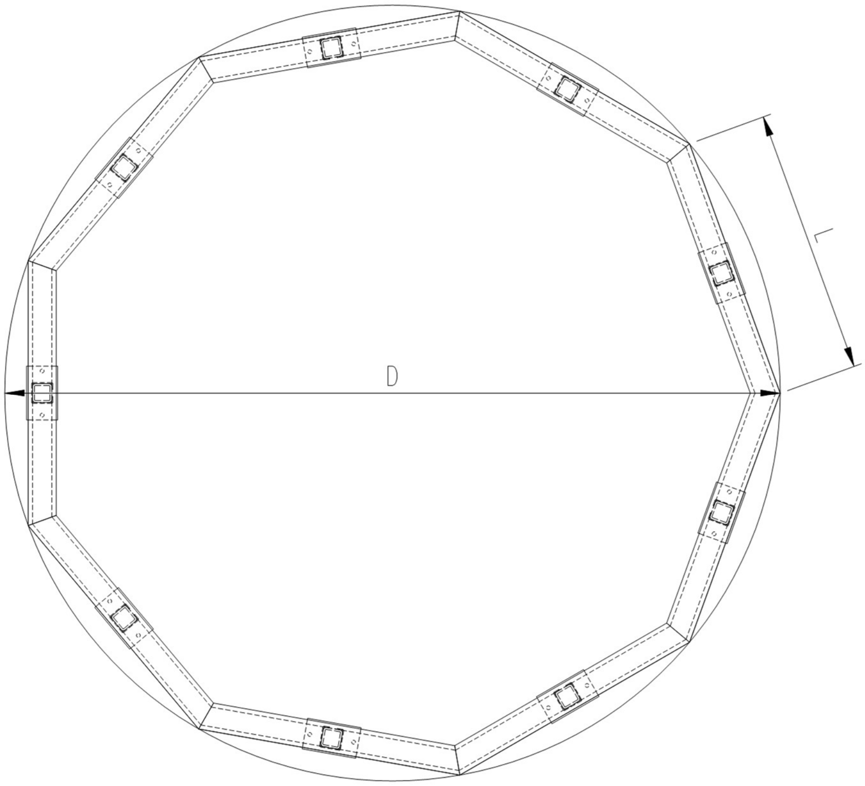
Handrail system PVCST01
with lateral fixing
STANDARD type

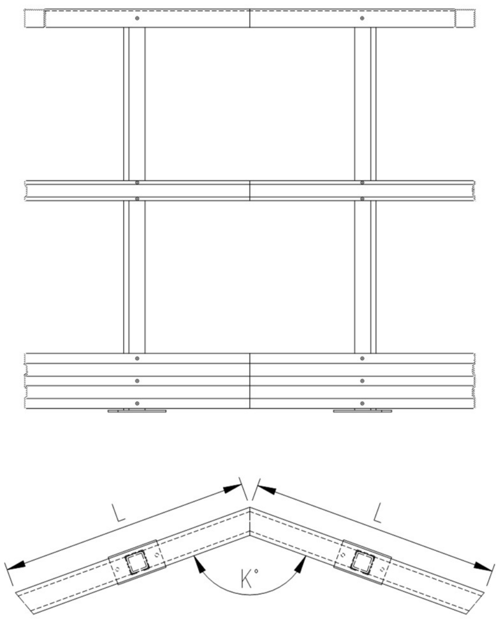


Handrail system PVCERG01
with lateral fixing
ERGONOMIC type

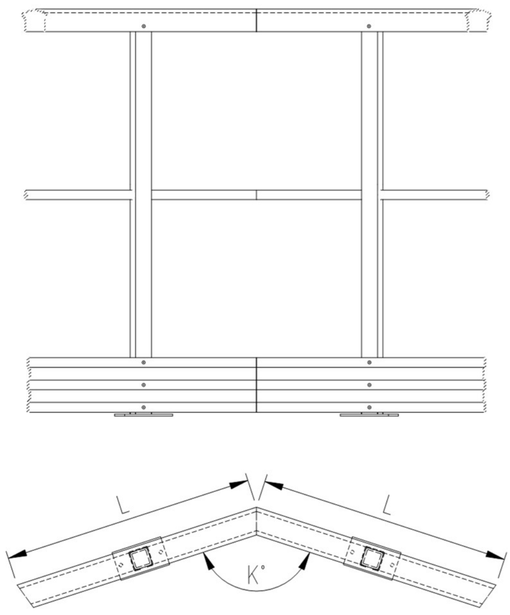
TYPE X (WITH ONE STANCHION PER MODULE) – FOR DIAMETERS < 10’000 mm
TYPE Y (WITH TWO STANCHIONS PER MODULE) – FOR DIAMETERS > 10’000 mm

ROUND HANDRAIL SYSTEM WITH HORIZONTAL FIXING





Handrail system POCST01
with horizontal fixing
STANDARD type



Handrail system POCERG01
With horizontal fixing
ERGONOMIC type

TYPE X (WITH ONE STANCHION PER MODULE) – FOR DIAMETERS < 10’000 mm
TYPE Y (WITH TWO STANCHIONS PER MODULE) – FOR DIAMETERS > 10’000 mm

5. INSTRUCTIONS FOR DESIGN ENGINEER

1. When the height of the possible fall exceeds 500 mm, a handrail system shall be installed (ref. UNI EN ISO 14122-3 norm)

2. Minimum height of the handrail system shall be 1100 mm (ref. UNI EN ISO 14122-3 norm).

3. The handrail system shall include at least one intermediate kneerail. The clear space between the handrail and the kneerail, as well as between the kneerail and the toe-plate, shall not exceed 500 mm.

4. A toe-plate with a minimum upstand of 100 mm shall be placed at 10 mm maximum from the walking level and the edge of the platform.

5. The maximum spacing (centre-to-centre) between the stanchions shall be:

   LINEAR HANDRAIL SYSTEM
   - max **1500 mm** for handrail system **POST01** (horizontal fixing)
   - max **1500 mm** for handrail system **POERG01** (horizontal fixing)
   - max **1500 mm** for handrail system **PVST01** (lateral fixing)
   - max **1500 mm** for handrail system **PVERG01** (lateral fixing)

   ROUND HANDRAIL SYSTEM TYPE X (ONE STANCHION PER MODULE) FOR DIAMETER < mm 10.000
   - max **700 mm** for handrail system **POCST01 – TYPE X** (horizontal fixing)
   - max **700 mm** for handrail system **POCERG01 – TYPE X** (horizontal fixing)
   - max **700 mm** for handrail system **PVCST01 - TYPE X** (lateral fixing)
   - max **700 mm** for handrail system **PVCERG01 – TYPE X** (lateral fixing)

   ROUND HANDRAIL SYSTEM TYPE Y (TWO STANCHIONS PER MODULE) FOR DIAMETER > mm 10.000
   - max **1500 mm** for handrail system **POCST01 – TYPE Y** (horizontal fixing)
   - max **1500 mm** for handrail system **POCERG01 – TYPE Y** (horizontal fixing))
   - max **1500 mm** for handrail system **PVCST01 - TYPE Y** (lateral fixing)
   - max **1500 mm** for handrail system **PVCERG01 – TYPE Y** (lateral fixing)

For handrail systems, tested according to UNI EN ISO 14122-3 PAR. 8.2, it is possible to request the tests carried out by contacting info@mmgrigliati.it.

6. ASSEMBLING INSTRUCTIONS

6.1 VERTICAL FIXING

The stanchions could be fixed laterally to the load bearing structure in two ways.

i. Completely adherent stanchion fixing

When the support beam of the structure is a C or tubular profile or a concrete beam, the fixing is very simple. On the bottom part of the stanchion, a plastic reinforcement is inserted in order to ease fixing screws M8 (Fig. 1) to the profiles or anchor bolts HST3 - R M8 l_{min} > 115 mm to the concrete (Fig. 2). The lengths and diameters of the anchor bolt refer to the condition of uncracked concrete, adequate distances from the edges and between stanchions' axes: the designer will check the type of anchor bolt according to the actual conditions of the concrete in which the installation has to take place.

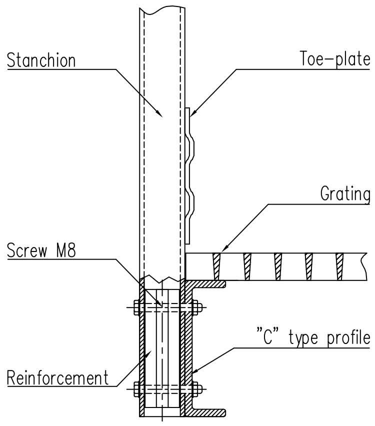


Fig. 1: fixing on profile

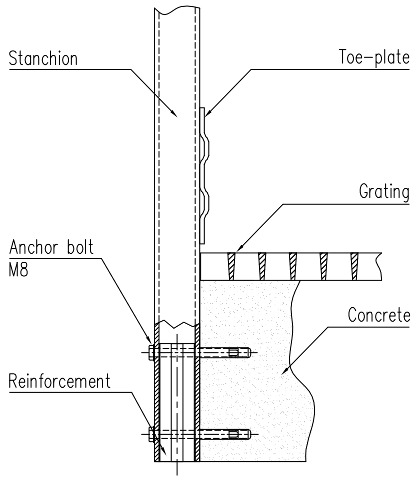


Fig. 2: fixing on concrete structure

ii. Incompletely adherent stanchion fixing

This is the case when fixing has to be made on an IPE or HEA type beam or whichever beam with wings. A steel plate has to be welded (if the beam is made of steel) or a spacer shall be fit into the recess (for FRP beams) in order to produce a flat surface (Figg. 3 e 4); then fixing has to follow as the above point i.

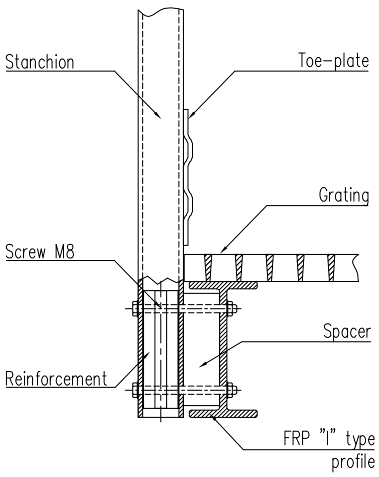


Fig. 3: fixing on an FRP beam

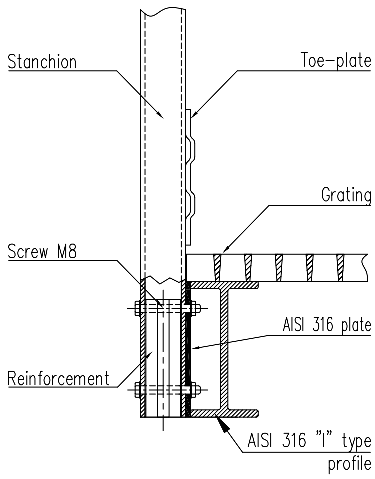


Fig. 4: fixing on a steel beam

6.2 HORIZONTAL FIXING

i. Base-plate permanent fixing

Stainless steel base-plate has to be fixed on a flat surface by using two expansion anchor bolts HST3 - R M8x75 or two screw anchors HUS-HR8x85 mm. The lengths and diameters of the anchor bolt refer to the condition of uncracked concrete, adequate distances from the edges and between stanchions' axes: the designer will check the type of anchor bolt according to the actual conditions of the concrete in which the installation has to take place. Then the stanchion is fit into the slot and fixed to the base-plate (Fig. 5) by an M6x70mm screw.

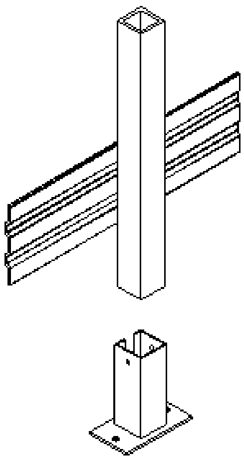


Fig. 5: Assembling illustration

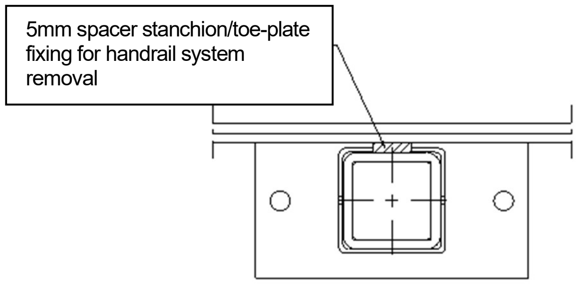


Fig. 6: 5mm spacer stanchion/toe-plate fixing for handrail system removal

ii. Base-plate removable fixing

It may be possible that the handrail system must be partially or totally removed: in this case the toe-plate, stanchion and a 5mm spacer, placed in a slot of the base-plate, shall have to be fixed by rivets. The gap created by the spacer between the outer face of the base plate and the toe-plate makes the removal of the handrail system easier (Fig. 6).

6.3 HANDRAIL APPLICATION

After the fixing of the stanchions, the installation of the handrail can follow.The C profile 60x50x5 mm or the Ergonomic C60x60x5 mm are placed on the top of the stanchion and pressed at level and until leaning on it. All stanchions must be perfectly straight before fixing the handrails. Fixing is made with rivets suitable for the specific environment but generally are in stainless steel. Two rivets are fit diagonally in the inside part of the handrail system and one on the outside part (Fig. 7).

6.4 KNEERAIL APPLICATION

The handrail system shall have at least one kneerail. The shaped kneerail profile of 55x5 mm or the tubular 26x19 mm kneerail, supplied in 6 m long bars, shall be placed in the middle of the clear span. The shaped profile 55x5 mm must touch the inside surface of the handrail system and be blocked by clamps. When they are perfectly horizontal, they could be fixed with two rivets on each stanchion. The tubular profile 26x19 mm will pass through a 27 mm drilled hole in the middle of the stanchion and needs no fixing (Fig. 7).

6.5 TOE-PLATE APPLICATION

The shaped toe-plate profile 150x5 mm is placed on the bottom part of the structure at 1 cm from the walking level. When it is in the required position it is fixed to the stanchion with clamp blocking systems and when it is perfectly horizontal it could be definitively fixed with three rivets for each stanchion (Fig. 7).

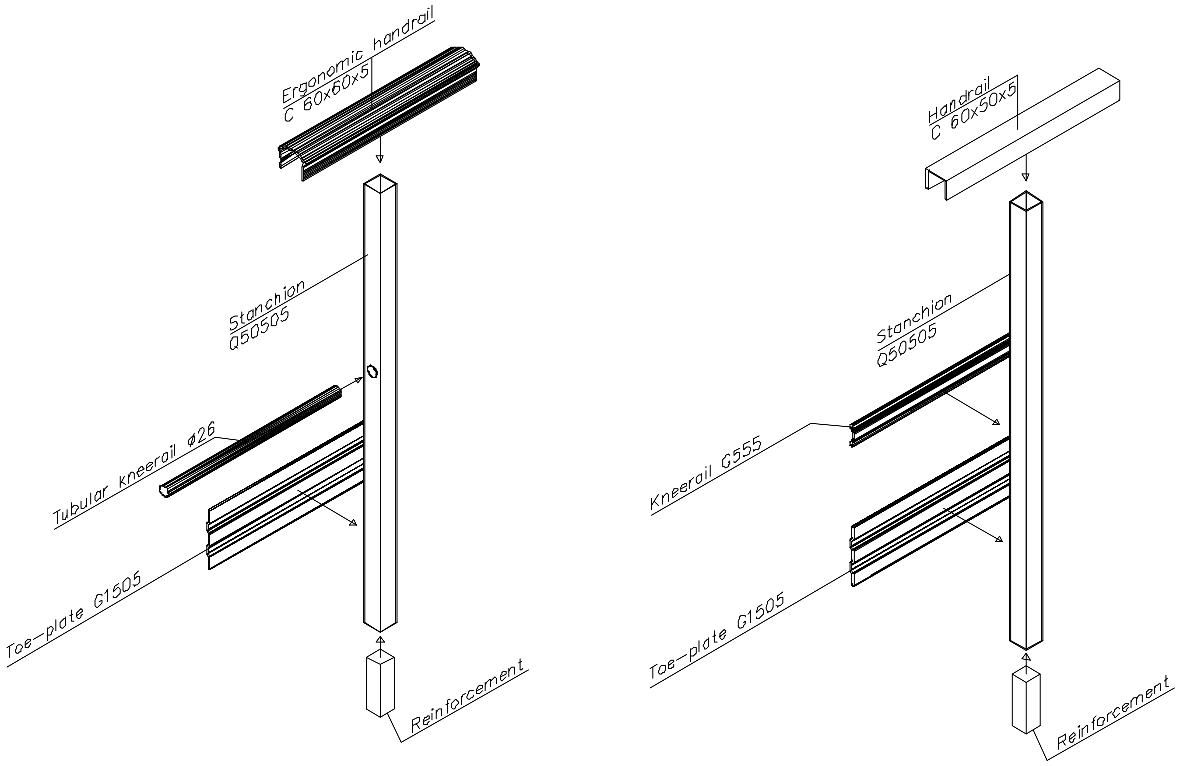


Fig. 7: fixing of handrail system components

6.6 JUNCTIONS

Shall the handrail system be over 6 m long it will be necessary to connect all the profiles in order to have a continuous structure.

i. Linear junctions distant from stanchions

If the junction is not on the stanchion, profiles are connected as follows:

- N. 1 square profile of 50x50x5 mm piece (approx. 10 cm long) and 8 M4 rivets shall be used for handrail (Fig. 8)
- N. 1 Stainless Steel plate 40x15mm, thickness 1.2 mm and 2 M4 rivets shall be used for shaped kneerail type G55x5 (Fig. 9)
- N. 2 Stainless Steel plates 40x15mm, thickness 1.2 mm and 4 M4 rivets shall be used for shaped toe-plate type G150x5 (Fig. 10)

We recommend making the joint as close as possible to the stanchion.

Fig. 8

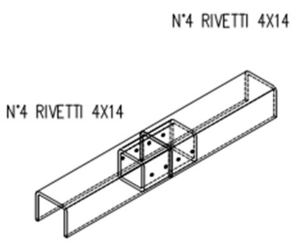


Fig. 9

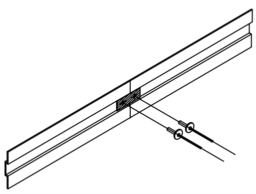
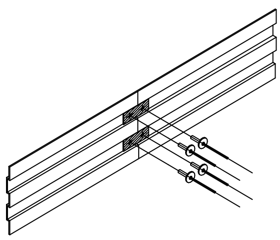


Fig. 10



ii. 90° or generic α angle junctions

For 90° or generic α angle connections, it is necessary to use:

- n. 2 stainless steel angles 40x40x40 thickness 1.2 mm to fit in the handrail and fixed with four M6x16 flathead screws (Fig. 16)
- n. 1 stainless steel angle 40x40x15 thickness 1.2 mm and two M4 rivets for the connection of the kneerail type G55x5 (Fig. 17). In case of ergonomic handrail, the connection between the two tubular profiles takes place by an articulated joint (Fig. 19)
- n. 2 stainless steel angles 40x40x15 thickness 1.2 mm and four M4 rivets for the connection of the toe-plate type G150x5 (Fig. 18)

It is suggested to use two stanchions in a 90° corner at a distance of approximately 100 mm (Figg. 20-21).

Fig. 16

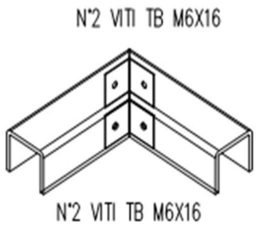


Fig. 17

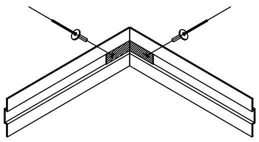
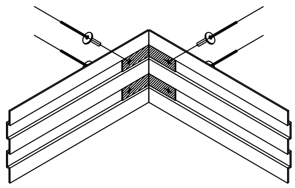


Fig. 18



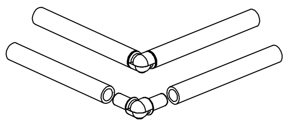


Fig. 19

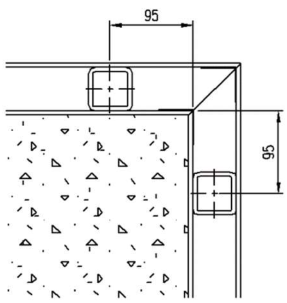


Fig. 20: Top view: stanchion's position for lateral fixing

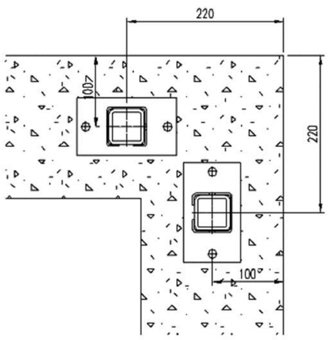


Fig. 21: Top view: stanchion's position for horizontal fixing