Plugs and anchors: Selection and assembly aids

When selecting the right plug or anchor for all purposes of use the following important factors need to be taken into consideration - here is some advice to help you make your choice:

1. The building material (anchoring base):
Plugs and anchors can only ever support as much a load as the anchoring base can handle.
Maryland Metrics fixing technology provides the proper technical and commercially economical solution from the catalogues of tried-and-tested proprietary brands FISCHER and UPAT for all intended uses.

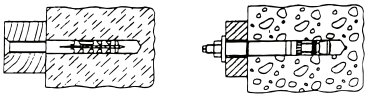
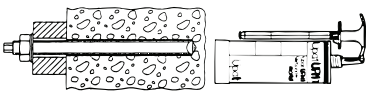
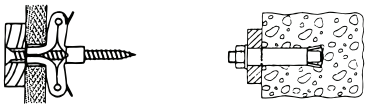
The building material needs to be able to take the expansion force of the plug or anchor during frictional contact (➜ Section 2) without suffering damage. (Approved plugs/anchors for the corresponding building material ➜ Table 6)

Table 1: Anchoring base acc. to building group

Concrete		Brickwork				Sheets/Panels
Normal concrete B 15 - B 55 C 15/20 - C 50/55	Light-weight concrete LB 10 - LB 55 e.g. Pumice/ expanded/porous (gas) concrete	**Solid brick dense structure**	**Perforated brick dense structure**	**Solid brick porous structure**	**Perforated brick porous structure**	Plasterboard / Chipboard / Fibreboard / Fibre cement panels
		e.g. Solid brick (MZ)/ Sand lime solid bricks (KS)	e.g. Honeycomb brick Sand lime Perforated bricks (KSL)	e.g. Porous concrete (G) Light-weight concrete (V)	e.g. Honeycomb brick Light-weight concrete Hbl	
BN	**BL**	**VD**	**LD**	**VP**	**LP**	**HP**

2. Mode of operation (load anchoring in the building material)
Plugs and anchors are classified into three groups according to their force transmission in the anchoring base.
This type of carrier mechanism is also a decisive factor for the anchoring base, resilience, edge distances and centre distances.

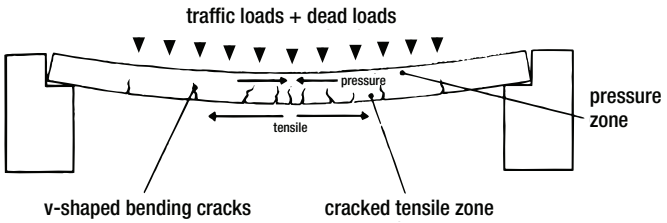
Table 2: Types of force transmission from plugs and anchors in the building ground

Force transmission:	**Frictional contact** (Traction from expansion)	**Adhesive bond** (expansion free)	**Form-fit** (expansion free)
Support mechanism:	Contact pressure of the expansion parts on the wall of the drilling hole = Friction > Tensile loads	Adhesive mortar joins with the anchor and anchoring base	Plug shape / Anchor part shape adapts to the drill hole shape
			
Plug / Anchor types:	Plastic expansion plug Metal expansion anchor	Compound / Reaction anchor Injection anchor	Cavity plug Zykon anchor

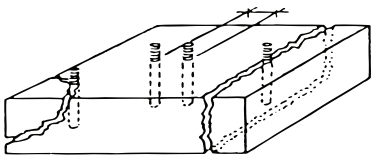
3. The area of use (pressure zone or tension zone?)
When using heavy-duty plugs/anchors in concrete it is decisive to know if the anchoring is to be carried out in the area of a proven pressure zone (consistently non-cracked concrete) or in a tension zone by itself (cracking concrete/concrete inclined to crack).
Tension zones with V-shaped bending cracks form in concrete due to its own weight, superficial loads, e.g. below ceilings. In this area of use, only plugs and anchors suited for crack/tension zones are permitted. Other plugs and anchors are only permitted for proved pressure zones.
(Tension-zone approved plugs and anchors ➜ Table 5)

4. The anchoring position
Plugs and anchors with high expansion pressure and heavy loads can lead to cracks or concrete edge failure of the component in any anchoring base, especially with narrow/flat components.

According to their mode of operation, dimensions and load magnitudes, the plugs and anchors have been assigned the following to prevent undesirable damage from happening:
– Minimum component thicknesses
– Edge spacing
– Axial spacing (with plug pairs/groups)
– Minimum anchoring depths/installation lengths (➜ Section 7) in the relevant technical approvals (➜ Section 9).



If in doubt, it is recommended to use tension zone approved plugs and anchors.



(* here the breakage due to excessively small distances is shown)

Non-binding typical values:
Edge spacing ≥ 2 x minimum anchoring depth
Axial spacing ≤ 4 x minimum anchoring depth
(the approval details are to be observed on a case-by-case basis)