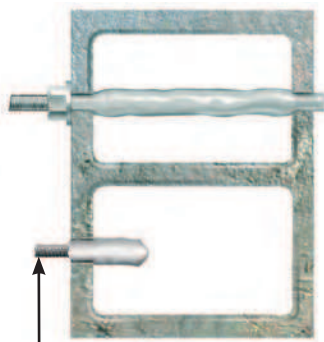




**The Inside  
Story About  
Mechanical  
and Adhesive  
Anchors**

**Types, Base Materials,  
Installation Procedures  
and More**



**Top View**

For attachments to single face of block, see page 43 for information on "umbrella anchors" and "stubby screens"

**HOLLOW CONCRETE BLOCK**

Maximum holding strength in concrete block can be obtained by fastening to both the front and back of the block using an adhesive screen tube and threaded rod.

**TYPES OF ANCHORS**



**Expansion Type—**

Tension loads are transferred to the base material through a portion of the anchor that is expanded inside the drill hole.

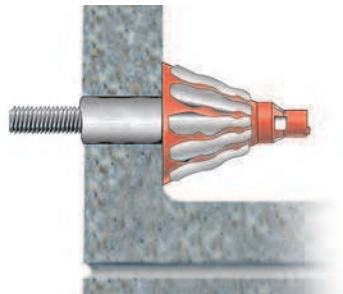
**Examples:** Red Head Trubolts, Dynabolts, Multi-Set II Anchors and Hammer-Sets



**Adhesive Type—**

Resistance to tension loads is provided by the presence of an adhesive between the threaded rod (or rebar) and the inside walls of the drill hole.

**Examples:** A7, C6, and G5 Adhesives



**Keying Type—**

Holding strength comes from a portion of an anchor that is expanded into a hollow space in a base material that contains voids such as concrete block or brick.

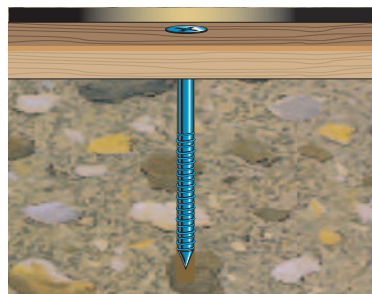
**Examples:** Adhesives used in screen tubes or umbrella insert



**Friction Type—**

Load capacity is created by driving a fastener into a pre-drilled hole that is slightly smaller than the fastener itself.

**Examples:** Redi-Drives



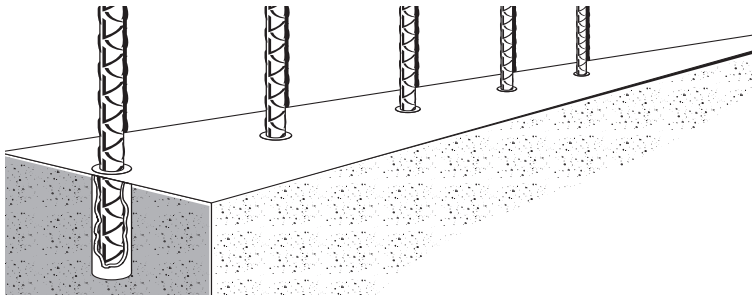
**Mechanical  
Interlocking Type—**

Tension loads are resisted by threads on the fastener engaging with threads cut into the base material.

**Examples:** LDT, Tapcon and E-Z Anchors

# Anchoring Working Principles

## BASE MATERIALS



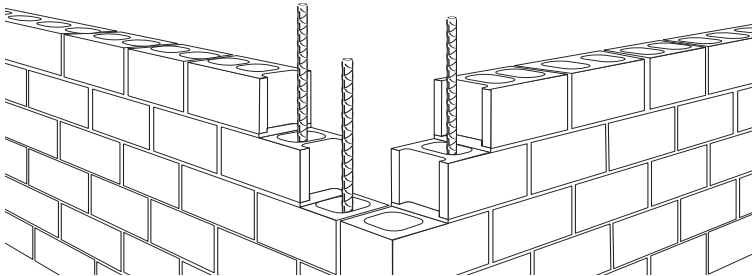
### Concrete

**Normal Weight Concrete** is made from Portland cement, coarse and fine aggregates, water and various admixtures. The proportioning of these components controls the strength of the concrete. In the United States, concrete strength is specified by the compressive strength\* of concrete test cylinders. These test cylinders measure six inches in diameter by 12 inches in length and are tested on the 28th day after they are produced.

**Lightweight Concrete** consists of the same components (cement, coarse and fine aggregates, water and admixtures) as normal weight concrete, except it is made with lightweight aggregate. One of the most common uses of lightweight concrete has been as a structural fill of steel decking in the construction of strong, yet light floor systems.

Typical fasteners for both normal weight and lightweight concrete include Trubolt Wedge Anchors, LDT Self-Threading Anchors, Dynabolt Sleeve Anchors, Multi-Set II Drop-In Anchors, Stud Anchors and Adhesive Anchoring Systems.

\* Compressive strengths shown in this catalog were the actual strengths at the time of testing. The load values listed were determined by testing in un-reinforced concrete.



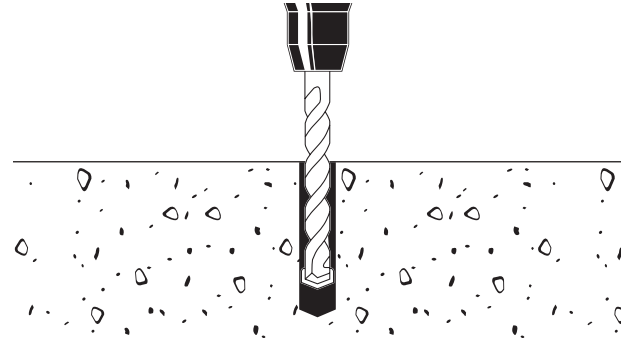
### Masonry

**Grout-Filled Concrete Block** consists of three components: concrete, mortar and grout. The mortar is designed to join the units into an integral structure with predictable performance properties. Typical fasteners for grout-filled block include Dynabolt Sleeve Anchors, and C6 or A7 Adhesive Anchoring Systems.

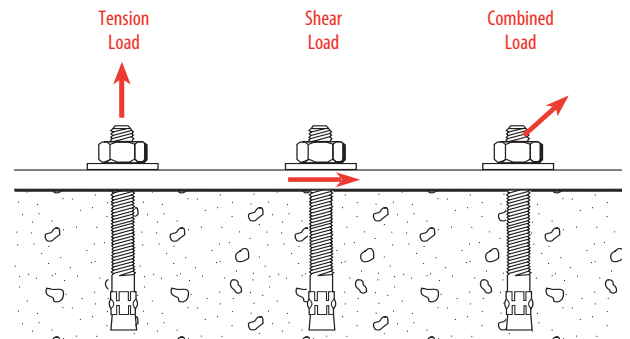
**Hollow Concrete Block, Brick and Clay Tile** are grouped together because they require special anchoring products that can be installed into a substrate that contains voids and still provide reliable holding values. Typical fasteners used in hollow block, brick and clay tile include Dynabolt Sleeve Anchors, Tapcon Self-Tapping Concrete Anchors, Adhesives with Screen Tubes and Adhesives used with the Umbrella Insert.

## INSTALLATION PROCEDURES

Anchor drill holes are typically produced using carbide tipped drill bits and rotary hammer drills. Look at the product sections of this catalog for the correct drill hole diameter and depth of each type of anchoring system.



Careful cleaning of the anchor drill hole is important in order to obtain the best possible functioning of the anchor system. For each product in this catalog, detailed installation instructions are provided. Suggested clamping torques and curing times (for adhesive anchors) are also provided.



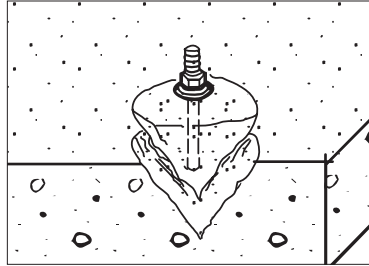
### Loading

Holding values for the following types of loading are provided in this catalog:

- **Tension loads—**  
when load is applied along the axis of the anchor
- **Shear loads—**  
when the loads are applied perpendicular to the axis of the anchor
- **Combined loads—**  
when both tension and shear loads are applied to an anchor, a combined loading equation is provided to determine the maximum loads that can be applied to the anchor at the same time

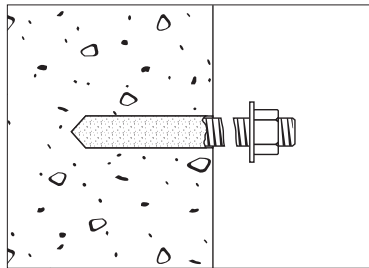
## MODES OF FAILURE

When anchors are loaded to their maximum capacity, several different types (modes) of failure are possible depending on the type of anchor, strength of the base material, embedment depth, location of the anchor, etc. Common modes of failure include:



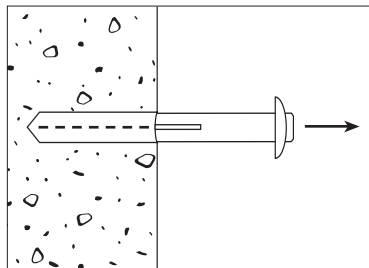
### **Concrete Spall Cone—**

Occurs at shallow embedments where the resistance of the base material is less than the resistance of the anchor and the base material fails.



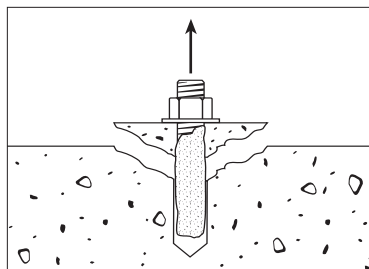
### **Steel Breakage—**

The capacity of the anchorage exceeds the tensile or shear strength of the steel anchor or rod material.



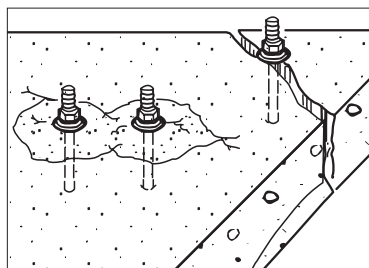
### **Anchor Pullout—**

Base material adjacent to the extension portion of an anchor crushes, resulting in the anchor pulling out of the hole until the capacity of the spall cone is reached, at which point the concrete will spall. This type of failure happens more commonly when anchors are set with deep embedment depths.



### **Bond Failure—**

Shear failure of the adhesive at rod-adhesive interface or adhesive-base material interface. Occurs more commonly in deep embedments using high strength steel rods.



### **Edge Distance and Spacing Reduction—**

Reduces the holding values, when anchors are placed too close to the edge. This also occurs when two or more anchors are spaced closely together. See suggested edge distance, anchor spacing distances and reduction values in the product sections.

Because applications vary, ITW RED HEAD cannot guarantee the performance of this product. Each customer assumes all responsibility and risk for the use of this product. The safe handling and the suitability of this product for use is the sole responsibility of the customer. Specific job site conditions should be considered when selecting the proper product. Should you have any questions, please call the Technical Assistance Department at 800-899-7890.