



CSDA Best Practice

Title:
Issue No.:
Effective Date:

Mechanical Anchors
CSDA-BP-012
Sep 20, 2011

Introduction

Mechanical anchors of different types are used by concrete sawing and drilling contractors on job sites. Two of the most common type of anchors in use in the industry are drop-in anchors and wedge type anchors. It is important for operators to understand how to use anchors safely to avoid potential accidents.

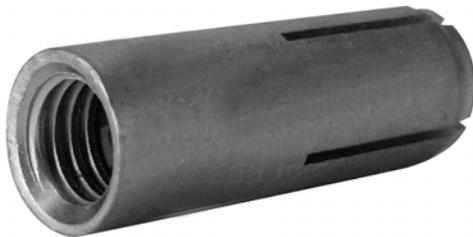
Sawing and drilling contractors should always read the manufacturer's installation instructions before using any anchor. Not following these instructions can negatively affect anchor performance—sometimes significantly. Manufacturers typically publish technical literature describing what the anchors are generally suitable for, what their load capacity is and what factors affect performance. If a contractor has any doubt about the anchors suitability, load capacity or has other questions, most manufacturers offer technical assistance.

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1. Drop-in Anchors

Drop-in anchors are internally threaded, female expansion anchors for use in concrete and are either lipped or non-lipped. Lipped drop-ins, when being installed, automatically stop when they are flush with the concrete surface. Non-lipped anchors can be countersunk below the surface.



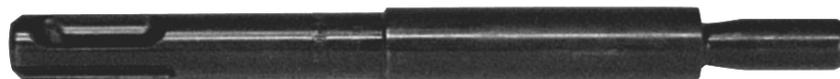
Drop-in anchor



Drop-in anchor with lip



Manual setting tool



Automatic setting tool

1.1. Properly Sized Drop-in Anchors

Calculations need to be performed to determine the loads (forces and moments) and to properly determine the quantity and physical size of anchor needed to safely secure the load. Calculating the load can be complicated—the weight of the machine and bit, offset loads, operator feed pressure and dynamic conditions—so if unsure, it is advised to involve a technical professional.

It is easy to underestimate the forces acting on anchors, especially on walls and ceilings. It should be noted that edge distances (the distance from the anchor to the edge of the concrete), spacing between anchors, concrete strength and condition all influence how anchors will perform. If using multiple anchors to handle larger loads, it should be determined how the load is distributed between the anchors to prevent overloading. Using multiple anchors in the same core rig baseplate slot requires special consideration, because the spacing between anchors, as well as unequal load distribution, can decrease anchor performance.

1.2. Properly Installed Drop-in Anchors

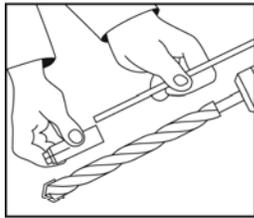
For a drop-in anchor to perform correctly, it is critical that it be properly installed per manufacturer instructions. This starts with the correct size hole. In addition, operators should use the correct diameter bit specified by the anchor manufacturer. Note that as a carbide bit wears, the diameter hole it drills becomes smaller and smaller. If the drop-in anchor cannot be easily inserted into the hole, either by hand or with a slight hammer tap, the bit should be replaced. Some bit manufacturers provide an indent or wear mark on the flute of the bit to help operators identify when the bit is worn.

Next, the hole should be drilled to the proper depth. Drop-in anchors are designed to be installed flush with the concrete surface. Never use a drop-in anchor that is not fully installed and sticks up above the concrete surface. Non-lipped drop-in anchors can be set below flush, but operators should make sure the resulting lower shear and bending capacities are considered.

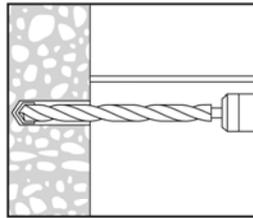
The hole should be cleaned as per manufacturer's instructions. The hole must be clean and free from dust and debris. Any concrete dust or slurry left in the hole can significantly affect the anchor's ability to perform. Depending on the instructions, a blow out bulb, blow out pumps or other forms of compressed air can be effective tools to clean the holes. Operators should make sure to insert the nozzle to the bottom of the hole to remove concrete dust from the entire hole. If water is used, the residual must be removed to avoid leaving slurry in the hole. Water can be flushed into the hole or a vacuum can be used to remove slurry from the hole.

The careful selection and proper use of a setting tool is essential. Setting tools vary between manufacturers and can wear over time, so it is advised to use the specified tool and make sure it is in good condition. Operators should not attempt to repair or grind a deformed or damaged setting tool. The dimensions are critical for proper anchor installation. If the setting tool becomes deformed it should be replaced. When using a tool to set the anchor, the shoulder of the setting tool should be fully driven in until it meets the top edge of the anchor. This will achieve proper anchor performance.

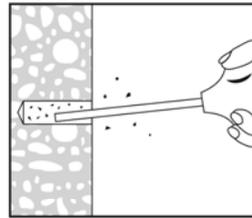
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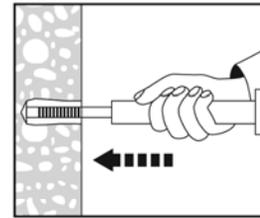
1. Adjust depth gauge to equal overall length of drop-in anchor.



2. Drill hole to the correct depth.



3. Clean hole.



4. Insert anchor and set anchor using proper setting tool. Drive tip into anchor until the the shoulder of the setting tool meets the top of the anchor.

1.3. Properly Adjusted Drop-in Anchors

Once an anchor is installed correctly, a properly rated threaded rod is screwed into the anchor. The rod should be turned into the anchor all the way, then backed off one turn or 360 degrees. A double-check of the rod should be done to make sure it is in far enough and “in equals out.” As an example, this means a 1/2-inch outer diameter is threaded into the anchor at least 1/2-inch or a 5/8-inch rod is in at least 5/8-inch. At this point, the nut or collar can be tightened down.

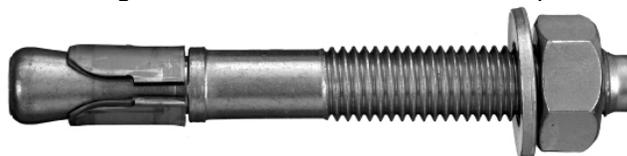
Operators should never over-torque anchors as permanent damage can occur. Torque guidelines should always be followed, as outlined by the anchor manufacturer. Adjusting the leveling screws on the rig base after the nut or collar is torqued can put additional load on the anchor. Leveling screws should always be adjusted first. Pulling wrenches across the body, or using long leverage bars or long wrenches invites over-torquing of the anchor. The maximum torque for these anchors is not large—a 1/2-inch drop-in anchor typically has a maximum torque of 20-30 ft-lbs. This information can be confirmed with the manufacturer. Lubrication of the threads should be avoided. This can cause overloading during torque-up, which can significantly affect performance.

2. Wedge Type Anchors

This type of anchor is a male mechanical anchor commonly used by cutting contractors for a variety of applications.



Wedge anchor with washer and rod coupler



Carbon steel wedge anchor with washer and hex nut

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Stainless steel wedge anchor with washer and hex nut

2.1. Properly Sized Wedge Type Anchors

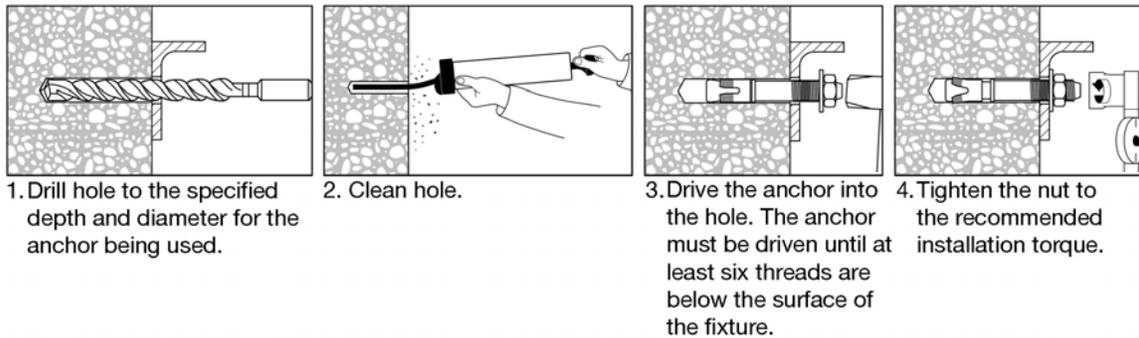
Calculations must be performed to determine the loads—forces and moments—that will properly determine the quantity and physical size of anchor needed to safely secure the load. Calculating the load can be complicated—the weight of the machine, offset loads, operator feed pressure and dynamic conditions—so if unsure, the operators should involve a technical professional. It is easy to underestimate the forces acting on anchors, especially on walls and ceilings. Operators should remember that edge distances, the distance from the anchor to the edge of the concrete, spacing between anchors, concrete strength and condition all influence how the anchor will perform. If using multiple anchors to handle larger loads, the operator should determine how the load is distributed between the anchors to prevent overloading. Using multiple anchors in the same core rig baseplate slot requires special consideration, because the spacing between anchors, as well as unequal load distribution, can decrease anchor performance.

2.2. Properly Installed Wedge Type Anchors

For a wedge-type anchor to perform correctly, it is critical it be properly installed per the manufacturer's instructions. Operators should use the correct diameter bit specified by the anchor manufacturer. It is important to note that as a carbide bit wears, the diameter hole it drills becomes smaller and smaller. The bit should be inspected regularly for excessive wear, especially when the anchor becomes difficult to insert into the hole. For easier identification of wear, some manufacturers provide an indent or wear mark on the flute of the bit. When the indent is no longer visible the bit should be replaced. Never allow the hole to get the anchors to fit the hole, as difficulty getting the anchor to fit is a certain sign the bit needs to be replaced. The hole depth should be at least 1/4-inch deeper than the desired anchor embedment. Operators should know what embedment depth is required for the application, as anchor performance is typically influenced by how deep it is installed. If the anchor cannot be left protruding from the concrete after the job is completed, operators can either cut or grind it off.

The anchor hole should be prepared for anchor insertion in line with manufacturer instructions. This includes making sure the hole is clean and free from dust and debris, as concrete dust or slurry left in the hole can significantly affect the anchor's ability to perform. Depending on the manufacturer's instructions, blow out pumps or other forms of compressed air can be effective tools to clean the hole. The nozzle should be pushed to the bottom of the holes to clean the entire hole. The wedge anchor should be hammered into the hole to the desired embedment, with enough threads driven past the surface of the rig baseplate to allow the anchor to pull up during tightening. A typical rule of thumb is to place the anchor at least six threads below the surface, but this should be verified with the anchor manufacturer.

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2.3. Properly Adjusted Wedge Type Anchors

Operators should use a washer sufficient in diameter and thickness to make sure it does not bend or pull through. The nut should be tightened to the manufacturer’s recommended installation torque. There should be sufficient threads so that the anchor fully extends through the nut. Do not over-torque wedge-type anchors as this can result in permanent damage. The installation torques for these type of 1/2-inch-diameter anchors is not large—typically 30-50 ft-lbs. This should be confirmed with the manufacturer. It is possible to over-torque. Using long leverage bars or long wrenches invite over-torquing of the anchor. Never lubricate the threads of the anchor, as this can result in overloading during torque-up and can significantly affect performance.

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