FastenerTalk

Number 105

Metal Building Systems Information

ATLAS Fasteners For Construction

Corrosion Resistance - The UltiMate® Screw

In Search Of Excellence

Ever since man first learned to make a fastener (or, a screw, as we once called them) from carbon steel, its functional utility has always been severely threatened by corrosion; and once the process has commenced, corrosion will continue until the fastener has completely deteriorated.

Corrosion can take many forms, and derive from many causes. Just the simple presence of rust can completely spoil the aesthetic appearance of a product when the fastener is used in an exposed and decorative situation. How many of us have seen bright, well-maintained, expensive mobile homes, whose appearance is completely marred by unsightly rust streaks, running from under the head of every exterior wall fastener?

In this case, corrosion has been caused by rain, or an environmental atmosphere. Corrosion can also start, however, by exposure to chemicals. The salt which we use to rid wintry roads of ice will play havoc with automobile bodies and the fasteners which hold them together.

In a different, but no less devastating form of corrosion, the mating of dissimilar materials will give rise to a condition known as “galvanic reaction” wherein an electric current is set up between the two metals, leading to the ultimate sacrifice of one metal to another.

Because Atlas, in its business, deals primarily with the metal building industry, this article deals only with corrosion problems as they relate to the heads of carbon steel fasteners, used in externally exposed applications on metal buildings, where corrosion can be expected to derive from atmospheric conditions.

It is extremely important to remember that where corrosion can be expected from chemical attack, such as the exposed shank of the fastener inside buildings (in fertilizer plants for example), or where the fastener and/or sheet and structure are dissimilar metals, remedies must be sought other than those discussed in the article.

Corrosive Resistant Systems

It is generally accepted that the only way to prevent, or at least substantially delay, the corrosion process is to create a barrier between the metal surface and the corrosive element.

Electroplating

Early fasteners relied on applying a thin coating of zinc to the surface of the fastener by the electroplating process, in order to prolong the life of the fastener.

Unfortunately, the electro-zinc plating can only deposit plating thicknesses in the range of .00015 inches to .0005 inches, with the norm being in the order of .0003 inches. We have long since learned that three ten-thousandths of an inch does not offer a lot of protection, particularly where the exposure is severe. The subsequent addition of clear chromate or colored dichromates does not substantially extend the life of the zinc coating.

Mechanical Plating

A considerable number of years ago, Atlas pioneered the introduction and use of the mechanical plating process in order to significantly increase the film thickness of the zinc plating. In the mechanical plating process, the zinc powder is placed in suspension in a chemical plating solution and “peened,” or literally pounded, onto the surface of the fastener by mechanical force. No electrical current is used at all.

This method enables us to increase the range of deposited thickness of zinc from .0005 inches to .001 inches, with .0007 being the norm. In other words, we can increase the thickness of the zinc plate by almost two-and-a-half times over the electroplating process.

Mechanical plating offers other advantages. The zinc coating can be deposited much more evenly over the entire surface of the screw and avoids the build-up of plating thickness on edges and thread peaks which occurs in the electroplating process. In addition, the application of dichromate conversion coatings is more effective, since the mechanical plating offers a more absorptive substrate. Most importantly, it eliminates the possibility of hydrogen embrittlement, a problem inherent in electroplating.

Paint Systems

With the development of the metal building industry and the increasing demand for color in sidings, paint was applied to heads of fasteners primarily for aesthetic purposes. However, it did also add a further degree of corrosion resistance.

Unfortunately, the integrity of paint films is easily lost when fasteners are installed. Metal chips in sockets, worn sockets, the use of impact tools instead of screw guns, all play a part in breaching the paint film.

Zamak Heads

The UltiMate screw with the Zamack head offers the most cost-effective way to ensure that the fasteners used to sheet and roof a metal building will still be in place in 20 years without any signs of rust, and only a minimal and acceptable degree of color-fade.

Metal Capped Heads

Over the years, other suppliers of construction fasteners have developed metal caps which are applied to the heads of fasteners. These caps consist of two types.

One version offers a thin, stainless steel cap which is crimped on, while the other consists of a substantially thicker cap, made from a zinc-alloy known as Zamak-3, which is also crimped on.

Because both of these products are caps, there is some possibility of moisture entering between the cap and the head of the fastener; and in instances of abusive application, these caps can become detached from the heads of the fasteners.

Post-Plating Films

In the last three or four years in an attempt to further extend the life of conventionally plated screws, and to offer a lower-cost alternative to nylon-headed or metal-capped fasteners, construction fastener suppliers have been selling products where the head has been coated with a long-life film, either alone or in conjunction with a conventional paint finish. Atlas offers such a product, its Oxyseal coating, which unquestionably will substantially extend the life of a conventionally-plated fastener, particularly when used with the addition of paint.

However, these systems can in no way offer the same advantages and qualities which can be derived from nylon-headed, or metal-capped fasteners.

The UltiMate® Screw - The Ultimate Solution

With nearly 90 years in the fastener manufacturing business, almost 30 of which have been devoted to manufacturing construction fasteners, we at Atlas can truly claim to be both pioneers and leaders in our industry.

In this role, we have expended a lot of time and research into the question of “what really is the solution to corrosion-proofing the head of externally exposed construction fasteners?”

We believe we have found that answer with the UltiMate® screw.

UltiMate® is Atlas’ name for their new zinc-alloy cast head fastener. Note that we say cast head, not capped head! There’s a world of difference!

In capped fasteners, voids between cap and head, and, as for nylon-head fasteners, improper tools and installation techniques can play havoc with caps stripped from the head.

The real answer, we believe, is that the integrity of head and shank must be maintained, exactly as for a conventional all-steel, one piece fastener.

The UltiMate® screw (as detailed in the attached drawing) has a precision die-cast zinc-alloy head which cannot be separated from the head of the fastener, unless it is cut away. Carried to extremes, the shank of the screw will break before the cast head will separate from the all-steel insert.

Cast from Zamak-5, an alloy of zinc, aluminum and manganese, it is the hardest grade of this metal available (unlike the Zamak-3 used in capped head fasteners, which must be a softer grade in order to withstand the stresses of crimping) and completely encapsulates the head of the shank with a thickness equal to almost a sixteenth of an inch.

The washer face is undercut to partially entrap the washer when the fastener is driven and prevent the unsightly extrusion of washer material from the periphery of the fastener head.

The simple design of the washer provides a perfect seal every time and the one fastener can be used for both siding and roofing applications. Where color-matching is required, the head of the UltiMate® screw can be painted in a conventional manner and provides a superior paint finish than that obtained on a conventional carbon steel screw.

Because of the quality, composition, and thickness of the die-cast Zamak-5 head, we confidently warrant that the head of this fastener will not display red rust for the lifetime of the building.

A detailed Specification and Test Data Sheet is attached to this article for your further information.

We believe that once you have used this screw, you will concur that it is truly - THE ULTIMATE SCREW!

The UltiMate® Screw

Specifications

Screw

Diameter	#10, #12,1/4", #17, 11/32"
Length	7/8" Lapscrew through 3"
Point Style	Stitch/Lap, TCP2, TCP3, A, AB
Head Style	Hex Washer with Undercut
Head Dimension	1/4" (.250),5/16" (.312),3/8" (.375) Across Flats
Material	Carbon Steel, C. 1022 - Shank Zinc Alloy -Zamak 5 -Die Cast Head

Washer

O.D.	15/32"
Thickness	.167"
Material	EPDM, Black
Durometer	80-85

Test Data

Pull-Out Values (lbs.) for Carbon Steel Self-Drilling Fasteners

Steel Thickness	12-14 TCP2	12-14 TCP3	1/4"-14 TCP1
2 x 26	159	/	211
2 x 24	246	/	332
2 x 22	286	/	431
2 x 20	378	/	565
18	608	544	803
16	851	760	1154
14	1184	1066	/
12	1858	1634	/
1/8	2571	2423	/
3/16	3523	3001	/
1/4	/	/	/

Pull-Out Test Results for Self-Tapping Fasteners

Steel Thickness	Point Type	Drill Size	Average Ulit-mate Pullout
26 (.018)	A AB	1/8" (.125)	519 lbs.
24 (.024)	A AB	5/32" (.156)	567 lbs.
22 (.030)	A AB	5/32" (.156)	641 lbs.
20 (.036)	A AB	5/32" (.156)	662 lbs.
18 (.048)	A,AB	3/16"(.187)	687 lbs.
16 (.060)	A,AB	3/16"(.187)	860 lbs.
14(.075)	AB	#7 .201)	1230 lbs.
12 (.105)	AB	#7 .201)	1681 lbs.
1/8" (.125)	AB	#2 .221)	1780 lbs.
10(.134)	AB	#2 .221)	1812 lbs.

Pull-Over Values

Thickness of Metal	Average Pull-Over Value - lbs.
26 GA. (.0179")	825
24 GA. (.0239")	975
22 GA. (.0299")	1120

Strength Characteristics for Self-Drilling and Self-Tapping Fasteners

Fastener Size	Min. Tensile (lbs.)	Minimum Fastener Torque Strength (In.-lbs.)	Fastener Shear (lbs.)
10-14	2100	61	1400
12-14	2800	92	2000
1/4-14	3850	150	2600
17-14	5200	175	3125
11/32	8000	300	4500

Strength of Zinc Cast Head on #12 Fastener

Thickness of Metal	Average Torque Applied to Fastener
3/16" Plate (.1875")	144 in.-lb.*

Degree of Separation of Zinc Casting from Steel Head	Rounding of Corners of Hex.
None	None

*(Min. required by IFI - 113 std. - 92 in.-lb.)

EPDM Washer

Sealing Capacity

Thickness of Metal	Torque Value When Sealed
18 Ga. (.052")	30 in.-lb.

Pressure Applied	Loss of Pressure
50 P.S.I.	24 Hrs. - None 48 Hrs. - None 72 Hrs. - None

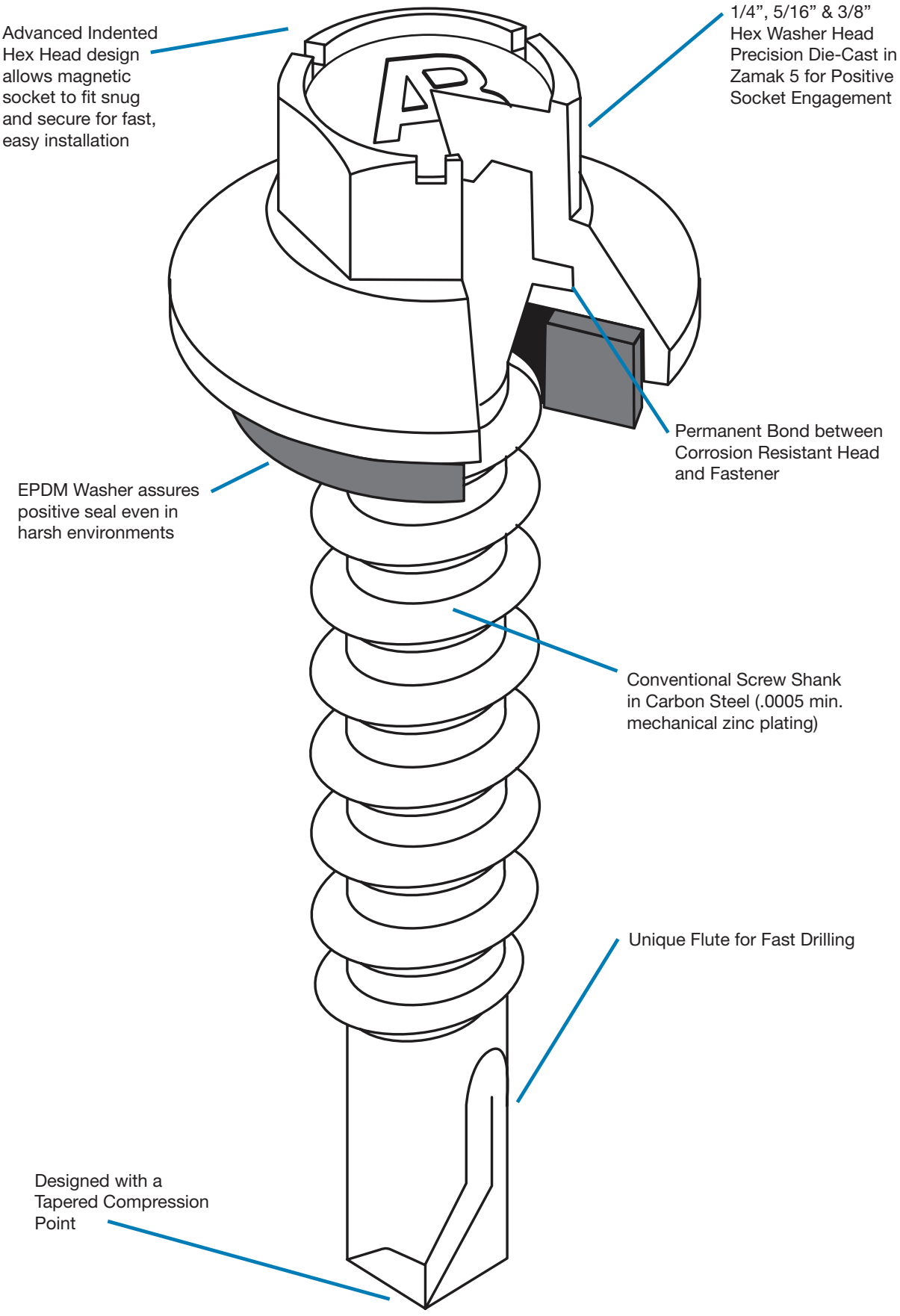
Ozone Resistance

Exposure	Duration
100 Parts per 100 Million @ 1040 F.	72 Hrs.

Degree of Deterioration
None

(NOTE! It is exlremely important that washers be EPDM). The use of Neoprene is NOT recommended as it will completely disintegrate after prolonged exposure to ozone.

The UltiMate® Screw



Techniques of Installation

As with any product, improper tools, bad application techniques or abusive handling, can prevent achievement of the purpose for which this fastener is intended - Long Life Corrosion Resistance.

Careful observance of the following points will ensure a satisfactory end result.

Tools

The preferred tool is a standard Electric Screw Gun, designed to operate at speeds in the range of 2,000 to 3,000 RPM. Tools which are designed for the installation of Thread Forming Screws and which operate in the range of 800 to 1,200 RPM, are not suitable for Self-Drilling Screws.

The use of Impact-Type Guns is not recommended.

Drive Sockets

Drive Sockets should be properly sized, of good quality, and the driving recess kept clean and clear of foreign particles. This is particularly true of Magnetic Sockets where metal chips will become entrapped in the socket.

Nose Pieces

For proper, and above all, consistent installation at proper Torque Values, use of a properly adjusted Nose Piece is essential.

Torque Values

The Torque Value of the Drive Tool must be equal to the Torque Value required to seat the thread forming portion of the screw.

While the strength of the fastener will accept Torque Values up to almost 150 in.-lb., this is far in excess of the value required to properly seat, and seal, the fastener. The required torque is only in the range of 25 to 50 in.-lb.

In Stitching applications (i.e. sheet to sheet) any excessive torque will result in the fastener stripping out.

Driving

1. Fasteners must be driven perpendicular to the work surface to prevent the drill point from “walking.” On curved surfaces, a dimple is recommended.

2. Normal pressure required for efficient driving is only 25 to 30 lb. Excessive pressure will only reduce this efficiency.

3. Spot Welds, “Hot-Spots,” or High Spots in Steel Thickness may dull the Self-Drilling Point to the extent that it will not drill completely through. Under these circumstances, simply use a second fastener to complete the operation.

Simple observance of the above points will ensure a proper job every time.

Warranty

Atlas warrants that the Zinc-Cast Head of every UltiMate® Screw will remain free of red rust, for the lifetime of the building.

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NOTE! Atlas reserves the right to make changes in the above specifications when Atlas, in its sale judgement, deems such changes to be necessary or appropriate.

ATLAS
Fasteners For Construction

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