FastenerTalk

Number 101

Metal Building Systems Information

ATLAS
Fasteners For Construction

18-8 Stainless Steel Self-Tapping Sheeting Screws

There are many cases where self-drilling screws with nylon heads, die cast zinc heads, stainless caps or 410 stainless screws have replaced self-tapping screws.

There are, however, many places where highly corrosive environments require the use of an all stainless screw made from 300 series wire.

Background

These stainless tapping screws were first used in significant quantities by major companies such as American Bridge, Alcoa and H. H. Robertson Company in the late 1950s.

At that time, all of the screws were made from 305 stainless and they presented many application problems. Screw failures as great as 15% were not uncommon.

Extensive research was required before a truly satisfactory screw was developed.

Atlas Bolt & Screw Company pioneered in this work and was the first company to produce large quantities of nickel-chrome stainless screws which performed exceedingly well when properly used.

Development work continued through the 1970s until a truly excellent stainless tapping screw evolved.

Again, Atlas was in the forefront of this development process.

Use on Pre-Engineered Metal Buildings

In the early days of the metal building, the only fastener used in significant quantities was a #14 x 3/4" indented hex head Type A carbon steel screw. This screw was used for virtually all applications.

As these buildings became more sophisticated, the manufacturers were confronted with the necessity of supplying stainless steel screws in isolated cases. As could be expected, they simply ordered the same #14 x 3/4" Type A screw in 305 stainless and the result was a disaster.

Memories of these screw failures lingered and metal building manufacturers strongly resisted the use of 18-8 stainless screws. There are still metal building manufacturers and erectors who do not understand the selection and application of these stainless tapping screws.
For this reason, we are repeating much of the information that we have published in previous technical bulletins.

The Problem

300 series stainless screws cannot be heat-treated without destroying corrosion resistance, therefore, the screw thread hardness is entirely developed by cold forming.

300 series material usually selected for cold heading has a low work hardening rate which will result in a screw thread far softer than required for applications in structural steel.

The Solution

After years of research, Atlas determined that it is necessary to hold certain elements in the stainless alloy to much closer tolerances than required by AISI specifications in order to assure maximum uniform hardness in the screw threads.

Also, the wire processing procedure can have a significant effect on the work hardening rate of the steel.

To produce a satisfactory screw the steel must have a much higher work hardening rate than ordinary 300 series alloys.

Atlas has a modified stainless alloy specification which, although it falls within the general 18-8 classification, is not the same as type 302, 303, 304 or 305. Our modified alloy always meets the requirements of AISI type 304; however, steel made to the 304 specification frequently will not meet our modified specification.

So far as corrosion resistance is concerned, no compromise has been made and our modified alloy is outstanding for sheeting applications where the atmosphere is extremely corrosive and a rust-proof shank is required.

Because of the high work hardening rate this alloy is slightly magnetic when cold worked.

Proof Of The Solution

To establish strength levels for these screws, tensile tests were made at Herron Testing Laboratories in Cleveland.

Screws tested were 1/4 - 14 type B with fluted threads made from our special hard grade 18-8 stainless steel.

Six tensile pulls were made showing tensile strengths ranging from 3830 lbs. to 3920 lbs. The average tensile strength was 3878 lbs. or 133,700 lbs. per square inch.

When torqued to breaking point, these screws showed values ranging from 165 to 170 in.-lbs. Strengths of this magnitude are remarkable for a non-heat treated fastener when one considers the following:

The minimum tensile required for a 1/4-20 heat treated Medium carbon steel grade 5 bolt is 3800 lbs. (SAE Standard J429d).

The minimum torsional strength requirement for a 1/4-14 type B heat-treated carbon steel tapping screw is 142 in.-lbs. (ANSI B18-6-4-1966).

Atlas has been the leader in this long development process and now excels in manufacturing these hard grade stainless screws and, undoubtedly, Atlas makes more of them than any other manufacturer.

Application Guidance

A good grade of carbon steel sheeting screws properly hardened can be carelessly used without damage to the screw. Also, Type A or Type AB carbon steel screws can be used in structural sections of considerable thickness. In addition to this, the same hole size can be used for a wide range of steel thicknesses. This is not true of 300 series stainless steel screws because they cannot be heat treated and they require care in application. Our suggestions follow:

Type of Screw

For fastening sheet to structure; generally, Type B or BP should be used. In sections approximately 14 gauge and lighter (not overlapped) type AB or A can be used.

For side-lap -stitching - type AB or A should be used. Although type A is widely used, we recommend type AB.

Size of Hole

The following recommendations are based on the assumption of that the lighter gauge structural sections (11 gauge and lighter) would be steel with 50,000 PSI minimum yield. If ordinary hot-rolled steel such as ASTM A-36 is used, the selection of the type of screw and the hole size will not be so critical. In heavier sections (3/16" and heavier), it is assumed that, generally, structural steel to ASTM A-36 will be used.

Holes should be drilled with 135 degree split point drills as follows: Sheet -to- structure for 1/4-14 type B, or AB and #14-10 type A.

Steel Thickness	Point Type	Drill Size	Average Ultimate Pullout
26 Ga, (.018)	A,AB	1/8" (.125)	243 lbs.
24 Ga, (.024)	A,AB	5/32" (.156)	340 lbs.
22 Ga, (030)	A,AB	5/32" (.156)	372 lbs.
20 Ga. (.036)	A,AB	5/32" (.156)	412 lbs.
18 Ga. (.048)	A, AB	3/16" (.187)	518 lbs.
16 Ga. (.060)	A,AB,B	3/16" (.187)	850 lbs.
14 Ga. (.075)	AB,B	#7 (.201)	1318 lbs.
12 Ga. (.105)	AB,B	#7 (.201)	1681 lbs.
1/8" (.125)	AB,B	#2(.221)	1780 lbs.
10 Ga. (.134)	AB,B	#2(.221)	1812 lbs.
3/16" (.187)	B	#2(.221)	2855 lbs.
1/4" (.250)	B	#2(.221)	3355 lbs.
3/8" (.375)	B	#2(.221)	3391 lbs.
1/2" (.500)	B	#1 (.228)	3500 lbs.

Selection of Screw Gun

An electric screw gun (approximately 600. rpm) is preferred. High speed impact tools are not good with these stainless screws. If they are used, great care must be exercised. Atlas does not recommend the use of impact tools with any of its screws.

Screw Driving Suggestions

The best screws will withstand considerable abuse, however, they can be made to fail - even if the hole is properly drilled.

The hole should be drilled perpendicular to the structure and the screw should be driven in the same manner.

If the screw is driven at an angle appreciably different from that at which the hole is drilled, thread roll-over is likely. As the thickness of the structure increases, the need for straight drilling and driving becomes more important.

If these precautions are not followed, the result may be partially stripped screws which will subsequently loosen with vibration - thus causing leaks.

In our opinion, so long as screw fasteners are securing sheeting on metal buildings, these very special stainless screws will be used where resistance to extremely corrosive conditions is required.

With many years of experience in this field, Atlas stands ready to supply the correct stainless screws for your applications and to provide assistance to assure proper installation procedures.

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