Powder-actuated fasteners and fastening screws in steel construction

Hermann Beck
Michael Siemers
Martin Reuter
Section 3.1.2.8
Screws should only be used in non-corrosive applications, regardless of their coating, unless they are specifically listed as being suitable for outdoor or exposed conditions. More detailed corrosion resistance guidelines for Hilti screw fasteners are provided in the Hilti North American Product Technical Guide Volume 1: Direct Fastening 2011, Section 3.6.1.6 on page 145.

Section 3.1.3
More detailed guidance on Hilti screw fastener installation instructions is provided in the Hilti North American Product Technical Guide Volume 1: Direct Fastening 2011, Section 3.6.1.7 on page 146. Screw fasteners should be installed with screwdrivers equipped with a torque clutch or depth gauge at the appropriate rpm’s. Caution should be taken with the use of rotary impact wrenches for installation of self-drilling screws in thin metal, as this can lead to over-driving and thread stripping.

Section 4.1.2.2
As of the printing of this article, certain seismic fastening applications are now recognized by the International Code Council – Evaluation Services (ICC-ES) for the use of powder-actuated fasteners. Recent revisions to the ASCE 7 reference standard and by incorporation, the IBC 2012, allow for the use of powder-actuated fasteners to resist seismic forces under certain conditions. Subsequent revisions to the ICC-ES Acceptance Criteria for Fasteners Power-Driven into Concrete, Steel and Masonry Elements, AC70, and powder-actuated fastener ESRs are underway consistent with ASCE 7-10 Section 13.4.5 and the IBC 2012. Interested readers should refer to the AC70 ESRs or contact Hilti for guidance.

Screw fasteners for cold-formed steel connections subjected to seismic forces are addressed through the American Iron and Steel Institute (AISI) S100 North American Specification for the Design of Cold-Formed Steel Structural Members. AISI S100 is referenced in the IBC 2012, and does not prohibit the use of screw fasteners for resisting seismic forces. Interested readers should refer to AISI S100, AC118 ESRs or contact Hilti for guidance.

Please direct powder-actuated and screw fastening technical inquiries to your local Hilti Field Engineer or Technical Support at 1-877-749-6337.
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Dipl.-Ing. Hermann Beck
Hilti AG, Schaan, Liechtenstein

Dr. Ing. Michael Siemers
Hilti AG, Schaan, Liechtenstein

Dipl.-Ing. Martin Reuter
Hilti Deutschland AG, Germany

Notes by the publisher Ernst & Sohn:
Updated annually, the “Stahlbau-Kalender” has been accompanying key
developments in steel construction and related areas in Germany since 1999.
The Calendar is both a compendium for planning and construction using steel as well
as a guide to its correct calculation and design. Timeliness, quality and the practical
content of the contributions emphasize the significance of the “Stahlbau-Kalender”
as a reliable source of information and aid, such that it has become an essential
handbook for engineers and architects who manage steel construction projects of
all sizes.
The editor, Professor Ulrike Kuhlmann, is head of the Institute for Design and
Construction at the University of Stuttgart, and her choice of authors is determined
by a continuous search for real-life examples. The contributors thus work within
the industry, in engineering offices or at the interface of research and practice in
academia and are renowned experts in their respective fields.
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Einleitung


Bild 1 zeigt typische Anwendungsbeispiele von Setzbolzen und Metallbauschrauben im Stahlleichtbau:
– Befestigung dünnwandiger Trapez- oder Kassettenbleche auf warmgewalzten Trägern bzw. dünnwandigen C- oder Z-Profilen,
– Verbindung dünnwandiger Kaltprofile untereinander.

1 Introduction

This publication is an updated and extended version of the article “Powder-actuated fasteners in steel construction” [1] from the “Stahlbau-Kalender 2005”. Powder-actuated fasteners are nails or threaded studs made from high-strength steel, used to fasten components to steel, concrete and masonry [2–4]. The materials most commonly fastened are steel, wood, insulation and, in some cases, also plastic. Powder-actuated fasteners are driven into the supporting material directly in a single operation. The powder-actuated fastening tool specified for each particular type of fastener must be used for the driving operation. Powder-actuated fastening to steel is a familiar technique that has been in use for decades. The classical applications in steel construction are the fastening of thin gauge metal sheets in single or multi-story buildings [5]: load-bearing sheeting of roof structures, liner trays for walls or sheeting of composite decks.

As an alternative to powder-actuated fasteners, fastening screws (self-drilling or self-tapping screws) can also be used to fasten profile metal sheets. Self-drilling screws can also be used at joints between thin-gauge metal profile framing. Accordingly, in addition to bringing powder-actuated fastening topics up to date, we have decided to integrate the subjects of fastening screw technology, applications and approval in this “Stahlbau-Kalender” and to compare the method with powder-actuated fastening.

Fastening screws, like powder-actuated fasteners, are made from hardened carbon steel or stainless steel. The various screw types are differentiated mainly in the ways in which they are used. A self-tapping screw, for example, is driven in a pre-drilled hole. The screw forms its own thread in the base material as it is driven. A self-drilling screw, on the other hand, is equipped with a drill point, so no predrilling is necessary. The screw drills the hole and forms a thread simultaneously in a single operation.

Figure 1 shows typical examples of powder-actuated fastening and screw fastening applications in light-gauge steel construction:
- Fastening thin-gauge trapezoidal metal sheets or liner trays to hot-rolled beams or thin C- or Z-profiles,
- Joints between cold-formed thin-gauge profiles.

The decision to use powder-actuated fasteners or metal construction screws depends, from a technological point of view, on the thickness of the supporting base material. In order to ensure a reproducible driving process, the material into which powder-actuated fasteners are driven must meet minimum thickness requirements. Depending on the fastening system used, this minimum thickness is between 3 and 8mm. Accordingly, the powder-actuated fasteners currently available on the market are unsuitable for the purpose of fastening profile metal sheets at overlap joints (sheet to sheet) or for fastening Z-brackets to profile metal sheets. Self-drilling screws are used predominantly in the field of construction where sheets of this thickness are involved.

Figure 1. Use of powder-actuated fasteners and screws in light-gauge steel construction