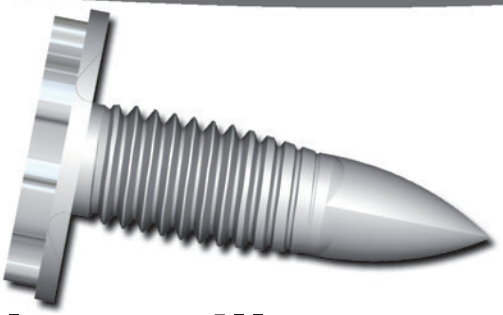
Semblex

FDS®

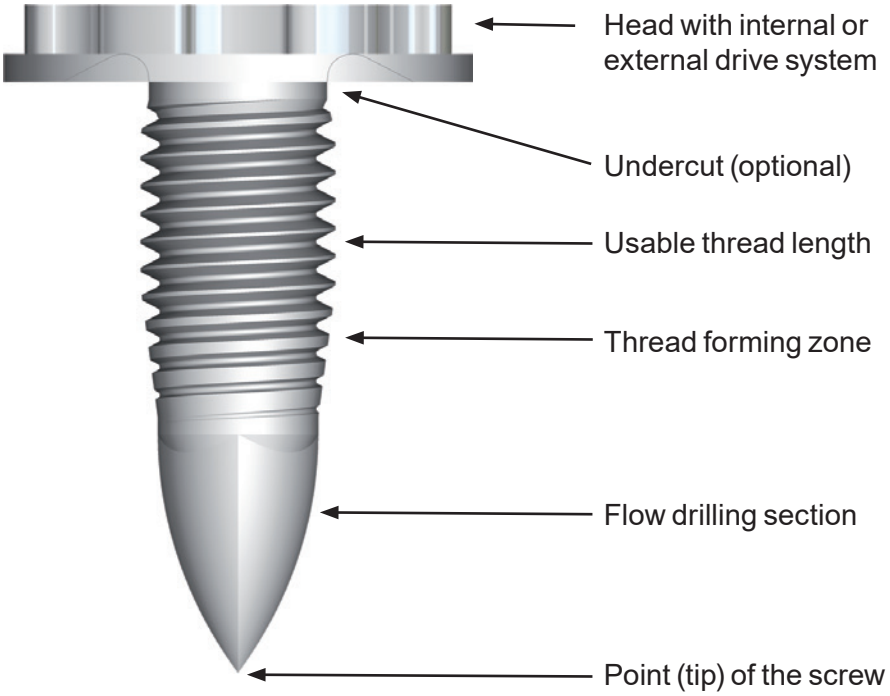


Flow Drill Screw for High-Strength Sheet Joints

Features/Benefits

Today's designers continue to search for ways to maximize performance and efficiency in their products. One approach that is being taken in the automotive industry and elsewhere is lightweighting. The utilization of thinner and lighter materials like aluminum can bring about significant weight reduction. The joining of these materials is critical to meet or exceed current performance levels. There have been many advancements in fastening technologies for these thin sheet joints, however the majority of products require two-sided access for installation. The Semblex FDS® flow drill screw was developed as an innovative single-sided fastening solution for these light weight thin sheet joints.

FDS® Features

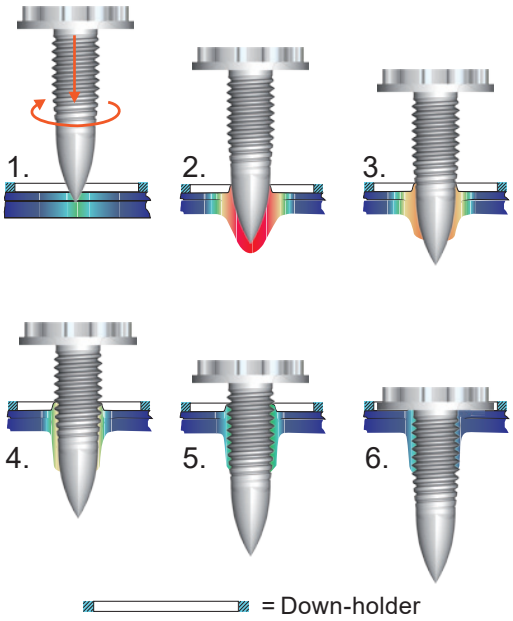


FDS® Benefits

- **One-sided access required for assembly**
- **Pre-drilling or punching of joined material not required**
- **Chip-less forming of female threads**
- **Deep extrusion created resulting in high thread engagement and joint strength**
- **Excellent drive-to-strip differentials for increased safety margins**
- **Eliminates welding costs and workplace environmental concerns**
- **Standard metric thread screws can be used in repair situations**
- **Effectively used with adhesives for enhanced joint performance**

FDS® Assembly without Clearance Holes

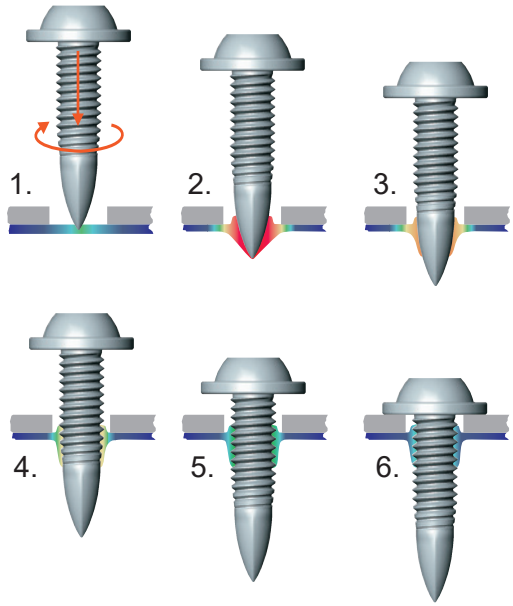
- **No part preparation required like pre-drilling or punching**
- **Undercut design required to capture up flowing material**
- **Down-holder (pressure foot) required to resist movement of top layer**



1. Warming up the sheet metal by axial end load and high speed
2. Penetration into the material
3. Forming of the extrusion
4. Chip-less forming of a female machine thread
5. Installation
6. Tightening with the pre-set torque

FDS® Assembly with Clearance Holes

- **Beneficial when top layer material is incompatible for flow drilling process**
- **Simplified head design may be used**
- **Down-holder (pressure foot) not required**



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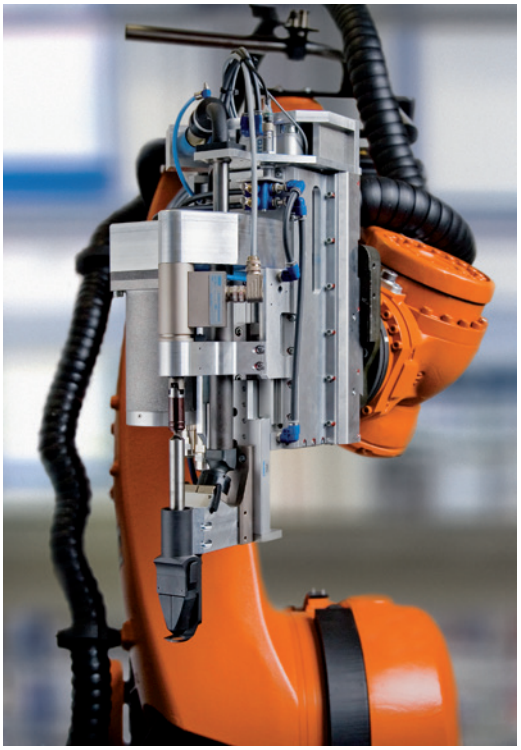


Fastening Equipment Selection

FDS® assembly requires the use of high speed automated drive systems which control and adjust speed, torque, axial load, and depth, through-out the multi-stage installation process.

Programmed assembly parameters are dependent on the following joint characteristics:

- Sheet thicknesses
- Number of layers
- Material properties
- Surface treatment
- Overall joint requirements

FDS® installation equipment is most commonly paired with robotics to allow for pre-programmed locating and assembling of joints in a variety of spaces and positions.

Semblex has relationships with a number of installation equipment manufacturers and integrators that can assist you with selection, building and installation of equipment.

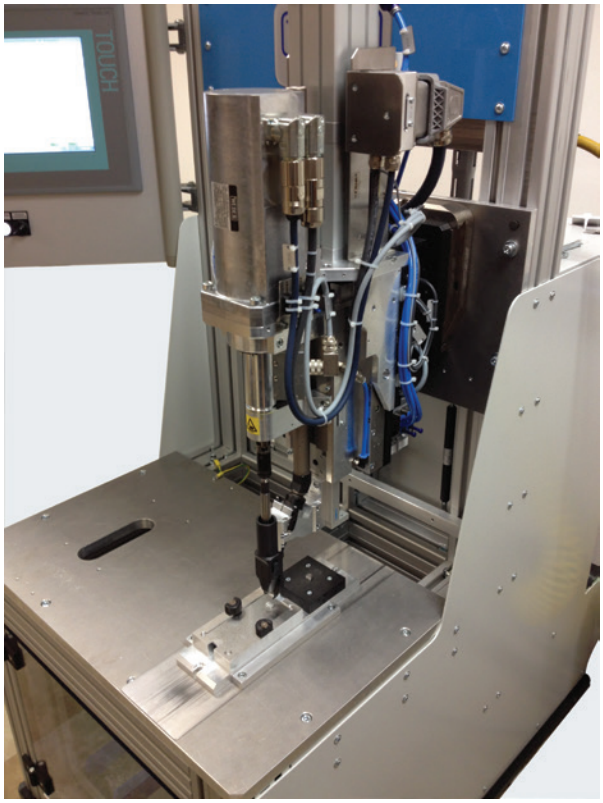
Test Equipment

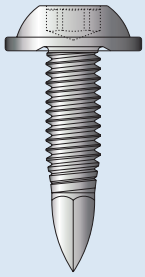
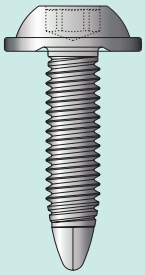
Semblex has the capability to perform drive testing utilizing a test stand mounted drive system.

Validation testing can be performed on material coupons to validate the feasibility of different material stacks and to help develop appropriate program parameters.

Tensile test equipment can also be utilized to gather peel and shear performance data.

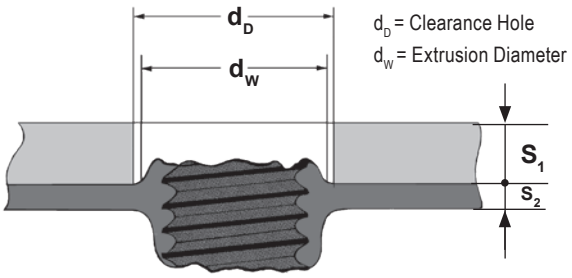
Please contact Semblex Engineering Services to discuss any testing needs you may have.



	Standard	PKS
FDS®		
Material and Heat Treatment	Case hardened mild steel Through hardened steel Induction hardening	Case hardened mild steel Through hardened steel Induction hardening
Finishes	Zinc with passivation Zinc-nickel with passivation Zinc flake with optional top coats Others upon request Additional lubrication is avoided in most applications to ensure adhesion of cataphoresic painting	
Application	No pre-hole in select layers	Pre-hole in all layers
Installation	Steel 0.4 - 1.8 mm Aluminum 0.8 - 5.0 mm Magnesium 0.8 - 4.0 mm	Steel 0.4 - 2.0 mm Aluminum 0.8 - 4.0 mm Magnesium 0.8 - 4.0 mm Stainless Steel 0.4 - 1.5 mm
Characteristics	Preferable for automated assembly Tolerance-free assembly because no misalignment with clearance holes Extremely high joint strength Ideal screw for safe assembly and dynamic loads	Preferable for manual assembly Due to bigger clearance hole compared to the smaller pilot hole, some tolerances can be compensated Low end load required

Recommended clearance hole diameter (d_D)

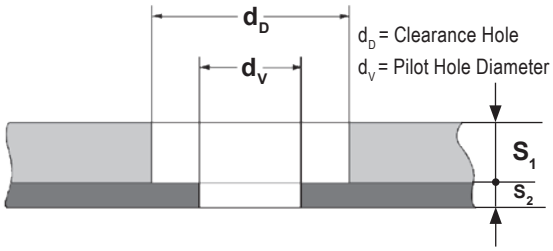
Flow drilling with the FDS® screw creates an extrusion in both the fastening and driving directions. When using a clearance hole this material can be contained avoiding the need for undercut head designs. The following are recommended clearance hole sizes.



FDS® Size	M4	M5	M6
d_D	5.1 - 5.7	6.7 - 7.4	8.2 - 9.1

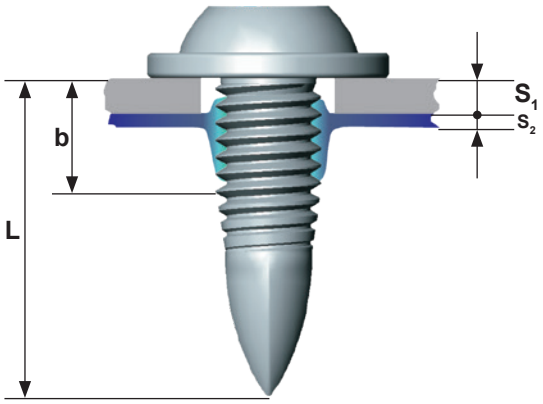
Recommended pilot hole diameter (d_V) for Type PKS

The optimum hole diameter depends on the respective range of requirements on the joint and should be specified according to the application.



FDS® Size		M4	M5	M6
sheet thickness S_2 [mm]	0.5	1.5 - 2.0	1.8 - 2.5	-
	0.63	1.6 - 2.2	1.8 - 2.5	2.0 - 3.0
	0.75	1.8 - 2.5	2.0 - 2.8	2.2 - 3.2
	0.88	2.0 - 2.6	2.2 - 3.0	2.5 - 3.5
	1	2.2 - 2.8	2.6 - 3.4	2.8 - 3.8
	1.25	2.4 - 3.0	3.0 - 3.8	3.4 - 4.5
	1.5	-	3.4 - 4.2	3.8 - 5.0
	>1.50	-	4.2 - 4.6	5.2 - 5.6

Part Length Considerations



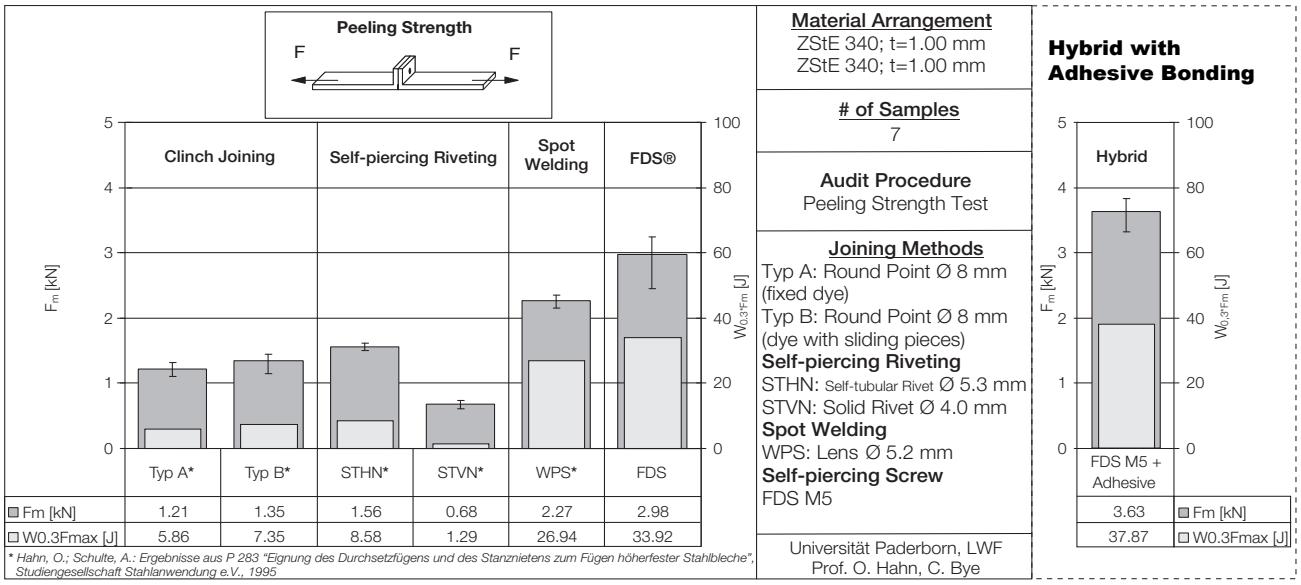
Standard FDS® Design
$b = S_1 + 3 \times S_2$

PKS FDS® Design
$b = S_1 + 2 \times S_2$

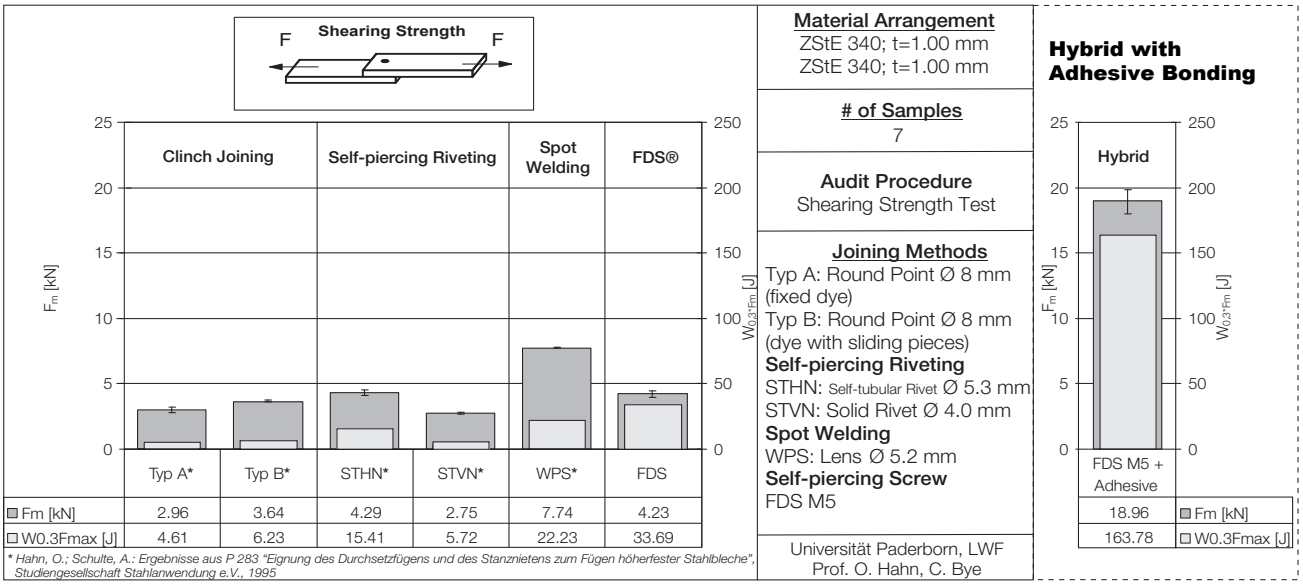
FDS®	M4		M5		M6	
	Standard	PKS	Standard	PKS	Standard	PKS
Length L [mm]	Usable thread length b [mm]					
12 + 0.8						
14 + 0.8	5.10	7.70				
16 + 0.8	7.10	9.70	4.90	8.20		
18 + 0.8	9.10	11.70	6.90	10.20	4.90	8.60
20 + 0.8	11.10	13.70	8.90	12.20	6.90	10.60
25 + 0.8	16.10	18.70	13.90	17.20	11.90	15.60
30 + 0.8			18.90	22.20	16.90	20.60
35 + 1.0					21.90	25.60
40 + 1.0					26.90	30.60
45 + 1.0					31.90	35.60
50 + 10					36.90	40.60
Additional sizes and lengths available upon request						

Peel and Shear Performance Comparison

Below you will find the achieved strength properties from assembling with FDS® fasteners as compared to other joining methods. Tests were completed in high strength sheet steel by the University of Paderborn in Germany. Also shown is the performance enhancements available when FDS® fasteners are combined with adhesive bonding.



Peeling strength F_m and energy absorption $F_{0.3*Fm}$ of different joining methods in steel (ZStE 340)



Shearing strength F_m and energy absorption $F_{0.3*Fm}$ of different joining methods in steel (ZStE 340)

NOTE: All data tables in this brochure are for guidance purposes only.

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