ABB’s StakPak IGBT press-pack differs from conventional press-packs in that the chips are individually sprung. This technology makes the StakPak more forgiving of mechanical tolerances and allows the assembly of long stacks.
# Contents

1. Introduction 3
2. Heat-sink mounting area properties 3
3. Clamp design 3
4. Application of silicon oil 4
5. Assembly 4
6. Gate drive unit mounting 4
7. Electrostatic discharge (ESD) protection 5
1 Introduction

Figs. 1 and 2 illustrate the fundamental difference between conventional and StakPak technology. The collector side of the sub-module pictured in Fig. 2 can be seen as the gray plates in the frame of Fig. 3. The force needed for a long stack may be far higher than that tolerated by the silicon chips being contacted via their sensitive surface microstructures. The rigidity and stability of a stack subjected to shock or vibration in service or during transportation depends on a mounting force that may not always co-incide with that required by the encapsulated chips. It is therefore important to decouple the two forces allowing the optimal force on the chips to be lower than the (optimal) force on the stack: the individual springs of the StakPak allow this as excess force is transferred to the frame walls.

StakPaks may be composed of differing numbers of sub-module e.g. 2, 3, 4 or 6. This mounting instruction applies to all versions.

2. Heat-sink mounting area properties

To achieve the specified performance of the device, the mounting surfaces should meet the following mechanical specifications:

- Flatness ≤ 20 µm over the sub-module area
- Flatness ≤ 100 µm over whole heat-sink
- Roughness Ra ≤ 1.6 µm

The heat-sink contact surfaces should be machined without ridges, steps or grooves. ABB recommends the use of nickel-plated heat-sinks. StakPaks have a nickel-plated copper cover and the sub-modules nickel-plated molybdenum-copper base-plates.

3. Clamp design

The device must be clamped with the force specified in the data sheets. To verify pressure distribution, ABB recommends the use of Fuji Prescale film or a similar product. For information on Fuji Prescale film, see www.fujiprescale.com or www.fujiprescale.net.

StakPak press-packs are designed to have a large pressure tolerance. As a result, the clamp assembly may be similar to that used for conventional, cylindrical devices as illustrated in Fig. 6. A clamp arrangement applying point force to a thick, rigid (e.g. hard steel) plate at the top and bottom of the stack, will allow sufficient pressure uniformity provided the plate has a minimum thickness. “a”. This thickness “a” is such that the contact surface of the StakPak beneath the heat-sink falls within the footprint of...
The choice of stack components (e.g., heat-sinks and isolators) must also take load cycling and its attendant wear and creepage into consideration. Good mechanical stability is essential and though this may be achieved with only two bolts for short stacks, four bolt constructions are recommended in long stacks (Fig. 7). If the mounting clamp and its bolts are at ground potential, insulation materials and clearances must be correctly determined (e.g., per standards IEC 60664-1 and prEN 50124-1). Insulating materials, such as Vetrest®, a glass-fibre epoxy from ABB, can be used for the bolts allowing a more compact construction than with steel bolts (which requires additional insulation or clearances).

4. Application of silicon oil

A thin film of silicon oil could be applied to the contact surfaces before the devices are assembled onto the heat-sink. The silicon oil must be carefully chosen for its long-term chemical stability, corrosion inhibiting properties, temperature range, electrical properties and ease of use. ABB recommends silicon oil type SF1154 (GE) supplied by ABB AB Logistics Center S-721 59 Vasteras (offer.selog@se.abb.com).

5. Assembly

The following paragraphs give advice on assembly procedures. Before assembly, the contact surfaces must be thoroughly cleaned using ethanol (or similar solvent) and a lint-free cloth. The assembly should be carried out in a clean environment free of dust and humidity as the surfaces must be kept clean during the whole assembly process. Heat-sink and semiconductor surfaces should not be touched with bare hands. We recommend the use of lint-free gloves for the handling of semiconductor devices and heat-sinks.

The heat-sinks and IGBT StakPaks should be handled with care to avoid scratches and other damage to the surfaces. Small scratches should be avoided (even though they are not detrimental to contact integrity since it is the overall surface finish which determines contact quality). The surface finish must remain within the specification given earlier and the plating should be intact to avoid subsequent corrosion of the underlying metal. Silicon oil should be applied sparingly and spread uniformly. Ensure that the devices are placed with the right polarity that the gate connection is in the right direction and that devices are correctly centred.

At the start of clamping, the mounting force indicator must be set to zero and the clamp supplier’s assembly instructions followed carefully. StakPaks, like all press-packs, should be fully clamped prior to attaching bus-bars to the assembly. This will avoid misalignment of the components during assembly.

6. Gate drive unit mounting

The recommended gate-connector is the AVX series 6338 card edge connector (part number 00-6338-020) http://www.avxcorp.com/docs/catalogs/6338.pdf. The cable connecting the gate-drive unit should be as short as possible and preferably oriented at a 90° angle to the main current direction to reduce the risk of magnetic induction in the gate leads. The attached gate connector will protrude slightly above the plane of the StakPak cover such that the heat-sink must have minimal overhang of the device on the gate side. Due to the height difference between compressed and uncompressed devices, the gate connector should be connected after

Fig. 6 - Sectional view of assembly in plane of applied force.

Fig. 7 - View of StakPak surface (perpendicular to force) showing footprint of force cone
stack assembly to avoid damage to the gate contact. The gate drive unit should be mechanically supported in order to withstand shock and vibration during transportation and operation. Since the gate driver unit is at emitter potential, it will need to be insulated from the rest of the assembly.

7. Electrostatic discharge (ESD) protection
IGBTs are sensitive to electrostatic discharge (ESD). All StakPak modules are ESD protected during transportation and storage. While handling the press-packs, the gate and auxiliary terminals should be short-circuited with the wire provided or with a metal strip to prevent damage by static charges (IEC60747-1, chap. IX). A conductive-grounded wristlet and a conductive-grounded working place are highly recommended during assembly.

8 Revision history

<table>
<thead>
<tr>
<th>Version</th>
<th>Change</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>Juni 2013</td>
<td>Björn Backlund</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evgeny Tsyplakov</td>
</tr>
<tr>
<td>04</td>
<td>July 2015</td>
<td>Björn Backlund</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evgeny Tsyplakov</td>
</tr>
</tbody>
</table>

Note
We reserve the right to make technical changes or to modify the contents of this document without prior notice. We reserve all rights in this document and the information contained therein. Any reproduction or utilisation of this document or parts thereof for commercial purposes without our prior written consent is forbidden. Any liability for use of our products contrary to the instructions in this document is excluded.