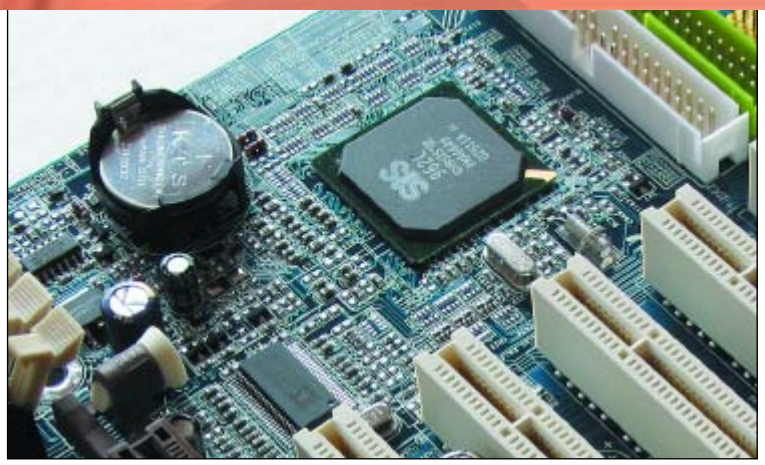
Stanyl® 46HF (High Flow™)

Innovative solutions for advanced electronic connectors

- Better productivity
- Better mechanical properties
- Easier to design
- Higher reliability



Stanyl® 46HF is the best choice for advanced electronic connectors.

Stanyl® 46HF

Stanyl® meets the needs of the electronics industry

The connector industry faces enormous challenges to meet the demands of the electronics industry:

- Highly dynamic, short life cycles, fast time-to-market, and time-to-volume.
- Drive to smaller parts (miniaturization) and higher data transfer speeds.
- Constant pressure to reduce system costs.
- Environmental pressures; reduced hazards in processes and disposal of electronic components.
- New manufacturing techniques such as SMT and lead-free soldering; only a handful of high performance materials can survive the high resultant temperatures.
- Trends in miniaturization challenge materials on processability, long flow paths through very thin channels, strict dimensional tolerances, high dimensional stability, good wall strength, and pin retention strengths, not only in connector manufacture but also in component assembly, testing, and use.
- No material today can fulfill all these requirements. Connector manufacturers have to find the best compromise for each component to deliver the cost and performance required by their customers.
- These challenges are faced particularly in the manufacture of memory cards, smart and other media cards, DDR-DIMM connectors, CPU sockets, FPC's, and other thin wall connectors.

These trends cause the currently used products to fail in at least one of the above aspects, but this is where Stanyl® 46HF excels.

Table 1 Summary of Stanyl® 46HF grades for the connector industry.

46HF5040	**40% glass-reinforced, flame retardant** High flow FR grade for connectors, ideal for LCP replacement in existing tools, 100% regrind listed
46HF5050	**50% glass-reinforced, flame retardant** Higher stiffness and lower warp alternative to the above grade - also FR, and better dimensional stability
46HF5041LW	**50% reinforced, flame retardant, low warpage** Low warpage grade FR for memory cards housings / parts where flatness and coplanarity are important
46HF4130	**30% glass-reinforced, non-flame retardant, heat stabilized** Developed for automotive connector applications that require high-temperature resistance, superior mechanical properties, and high-flow

The Stanyl® High Flow™ series (Table 1) has been developed specifically to meet the demands of the electronics connector industry. Stanyl® High Flow™ grades meet these challenges. They provide the optimum balance of performance and processing behavior and have become the first choice material of leading connector manufacturers for new and demanding thin wall connectors. Stanyl® High Flow™ grades for the electronics industry are all Underwriters' Laboratories (UL) V-0 rated. They have exceptional flow, very high weld line strength, exceptional toughness, very high pin retention, and exhibit a lower tendency to warp than standard Stanyl® grades.

Stanyl® is the world's first choice for advanced connectors

The most important factors for high quality connectors are strength, pin retention force, flatness, and planarity. Increasingly connectors are colored to distinguish the various types and in such cases the color stability becomes important.

Connectors normally go through a lead-free soldering process in the manufacturing stage. During lead free soldering, the connector is exposed to temperatures as high as 260°C (500°F) for short durations. These temperatures are high enough to degrade the performance of the connector because of changes caused in some polymer materials. It is here that the connector material is challenged to its limits. Key issues during assembly of the connectors to other devices are:

- The connector walls need to withstand the forces of insertion into the motherboards and other devices. The strength of the wall becomes very important.
- The connector pins need to be held very firmly in the connectors to ensure the integrity of signals through the pin. For that reason, pin retention strength becomes a critical factor.
- The connectors need to perfectly mate with other connecting devices that are made to very stringent dimensions. Also, co-planarity must be ensured so that the pins are perfectly in alignment when connected to other devices. Therefore, warpage must be minimized.

Stanyl® outperforms competitive materials on all these factors. No wonder Stanyl® 46HF is the first choice for the manufacture of high quality connectors among world leading connector companies who reap the benefits of switching to Stanyl®.

Stanyl® is the world's first choice for advanced connectors (cont)

Strength of connector

Stanyl® delivers the best connector strength performance before and after lead-free soldering! The graphs on this page compare Stanyl® to alternative materials. Strength retention for Stanyl® is very high even after high temperature lead free soldering when compared to the other materials under the same conditions. Since connectors are used primarily after soldering, connectors made from Stanyl® have the best performance during this step of assembly and also during use.

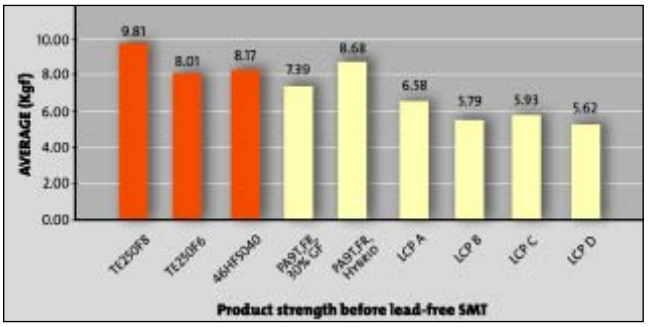


Figure 1 Product strength before lead-free SMT.

Pin retention strength

Stanyl® 46HF significantly reduces failures due to pin pull out during use, when compared to LCP or semi-aromatic polyamides. Stanyl® 46HF retains its properties after lead free soldering much better than other materials commercially used for connectors. Stanyl® also has excellent creep resistance so that connectors made with Stanyl® maintain their high pin retention characteristics throughout the useful life of the component. Figure 3 illustrates the results of the pin retention tests.

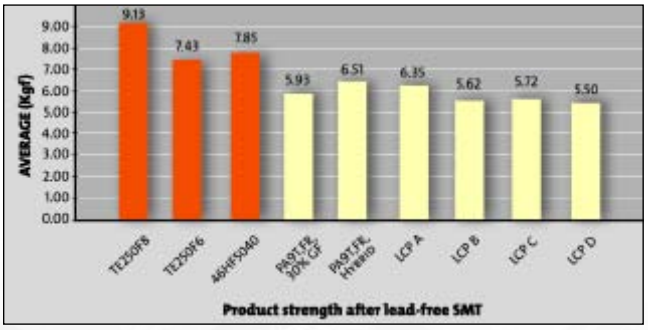


Figure 2 Product strength after lead-free SMT.

Strict dimensional tolerances met through low warpage

Stanyl® 46HF5041LW exhibits even lower warpage than LCP's. Connectors made from this grade are flatter and meet the co-planarity requirements and dimensional tolerances. Easier compliance with strict dimensional tolerances provides higher design flexibility. The shrinkage of Stanyl® 46HF grades is comparable to that of LCP's, both before after IR reflow soldering.

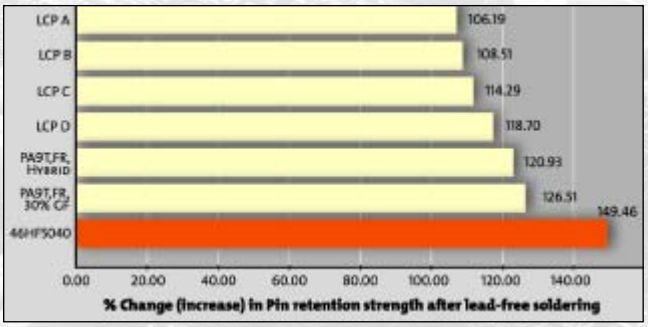


Figure 3 % Change (increase) in pin retention strength after lead free soldering.

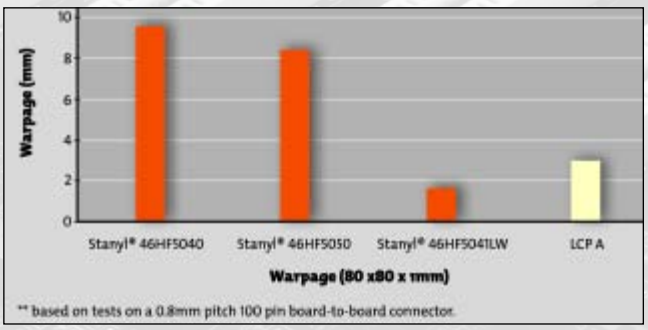


Figure 4 Stanyl® offers low warpage allowing for strict dimensional tolerances.

Stanyl® 46HF increases productivity and enhances design freedom

Stanyl® 46HF grades have very high flow which:

- Improves the ease with which complex parts can be manufactured.
- Increases productivity through the number of cavities that can be reliably filled in multi-cavity tools.

Stanyl® 46HF's remarkable high flow enables the molding of thin walls and long design channels

Stanyl® 46HF has brought about major changes in the design and manufacture of thin walled connectors. Design freedom is facilitated by the exceptional flow of the Stanyl® 46HF series combined with its excellent mechanical properties. You can now manufacture thin walled components down to 0.3 mm even with very long flow paths. With Stanyl® 46HF the risk of part breakage during molding, short shots, or distortion due to the molded-in stresses from high injection pressures is alleviated. This enables higher pin densities to be accommodated. Snap fit assembly designs are possible due to the exceptional toughness of Stanyl®. Other connector materials such as LCP or the PA9T or PA6T semi-aromatic polyamides cannot match this flow and performance combination that is pivotal in realizing overall system cost reductions.

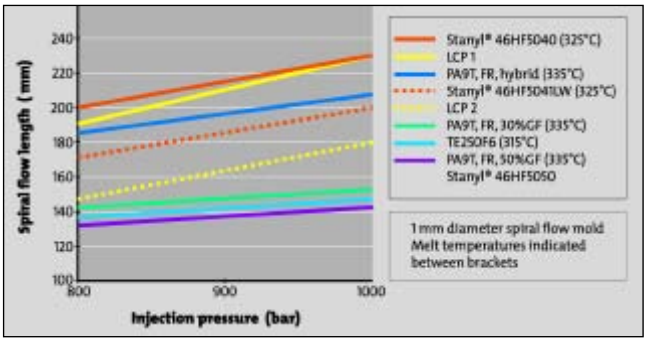


Figure 5 Spiral flow length.

The lower injection pressures required to fill molds allows productivity to be increased through the use of tools with more cavities than those possible with other materials. Lower injection pressures also result in less tool wear. This provides its users with significant savings in tool repair or even tool replacement costs, especially when maintaining tight dimensional tolerances over the life cycle of the product.

Best weld line strength in its class

Higher pin densities and thinner walls increase the risk of breakage during all manufacturing stages. This risk is reduced when materials with a high weld line strength and a high weld line elongation at break are used. These materials withstand operations such as high-speed pin insertion and repeated mating and unmating during testing without leading to component failure. The weld line strength of Stanyl® 46HF grades is superior to LCP's and semi-aromatic polyamides such as PA9T and PA6T.

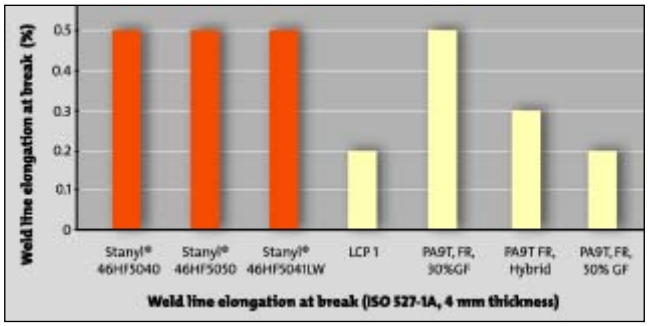


Figure 7 Weld line elongation at break (ISO 527-1A, 4 mm thickness).

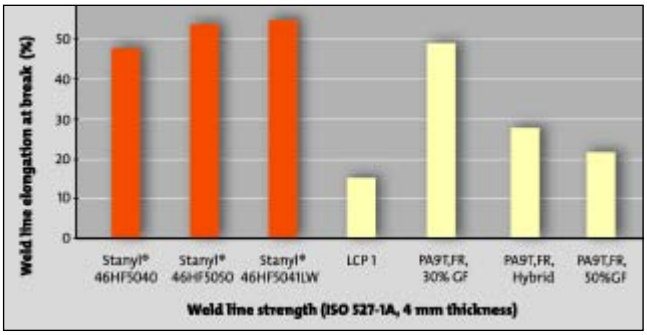


Figure 6 Weld line strength (ISO 527-1A,4 mm thickness).

Weld line elongation at break of Stanyl® 46HF grades is also much higher than for other materials. Stanyl® 46HF connectors are more capable of withstanding very high forces during manual or automated assembly steps and pin insertion, resulting in lower reject rates.

Stanyl® 46HF

Productivity gains with Stanyl®

Stanyl® 46HF offers considerable savings on production costs.

- Fast cycle times; 20-25% lower than semi-aromatic polyamides, similar to LCP.
- Lower melt temperatures, result in energy savings.
- Lower mold temperatures of 80°C (175°F) or less; eliminate expensive, maintenance-intensive electrical or oil heated tools, standard water heated tools are easier and safer.
- High regrind percentages are allowed without compromising its UL V-0 rating, even at low wall thickness.
- Lower injection pressure allows more cavities in molds compared to other materials, leading to higher productivity on similar sized machines.
- Low injection forces lead to very low molded-in stresses significantly reducing deformation when subjected to a post-molding heat treatment like soldering (e.g. even on long connectors with high pin density and low form factors). This also leads to low reject rates, typically below 0.3-0.5% due to better dimensional tolerances of Stanyl® 46HF.

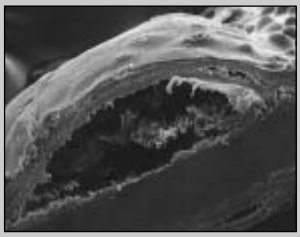
Soldering
With its short term temperature resistance as high as 290°C (555°F), measured by HDT, Stanyl® has very high heat resistance and exhibits little change in its mechanicals properties. This makes it the best choice for connectors that use lead-free soldering methods.

Stanyl® accommodates the high temperatures encountered during assembly of connectors onto a PCB using IR or hot-air reflow soldering or other use without problems. The newly introduced and environmentally friendly, lead-free soldering process which features higher temperature profiles can safely be used with products manufactured in Stanyl® due to its intrinsic high HDT values.

With respect to blistering, Stanyl® parts with a thickness of less than 0.5 mm safely "breathe out" excessive moisture and do not result in any blistering when heated to the elevated temperatures encountered in all types of soldering processes. For thicker parts, blistering may occur under specific combinations of design and environmental factors. DSM has extensive know-how on the phenomenon of blistering and how to prevent it in almost all cases where there is a risk of it occurring. By taking simple precautions to avoid any eventuality of blistering, the outstanding properties of Stanyl® can be exploited for any connector design. Other materials may have a lower tendency to blister but the risk is still present and they cannot match Stanyl® for its overall performance in other respects and system cost saving potential. This is why the best connector manufacturers in the world choose Stanyl® 46 for thin wall connectors!

What is Blistering?

Moisture absorbed by connectors before soldering becomes critical because of the high temperatures encountered in this process. During high temperature operations excessive moisture previously absorbed by the components can be given off rapidly, pushing out the surface of the component where the moisture is released. This phenomenon is known as "blistering". In other materials, blistering can also be caused by rapid out-gassing of volatiles at temperatures near the melting point of the material, as resistance to deformation is low.



All polyamides absorb moisture due to the presence of the amide linkage. The degree to which polyamides absorb moisture is related to the number of amide groups per given polymer chain length. In the case of Stanyl® the number of amide groups per chain is very high. This gives Stanyl® its excellent mechanical strength, toughness, and thermal resistance, but it also makes it more susceptible to absorb moisture under humid conditions.

Blistering in Stanyl® parts is caused solely by moisture and if moisture can be eliminated, or expelled from the part, before the highest temperatures are encountered, blistering will not occur in Stanyl®.

Property	Stanyl® PA46 HF	LCP
Cycle time (seconds)	17.5	18
Shrinkage (%)	0.2*	0.05
Bow (mm)	0.03	0.08
Regrind-UL limit %	50-100	50

*After moisture uptake, equivalent to LCP
Note: Example in the case of processing DDR - DIMM (Double Digit Rate - Dual Inline Memory Module)

Table 2 Property performance of Stanyl® versus LCP.

STANYL® 46HF IS THE BEST SOLUTION FOR YOUR THIN WALLED CONNECTOR!

Stanyl® 46HF grades are the industry's preferred material for leading-edge technology connectors providing:

- High flow characteristics for thin wall or highly detailed parts; better than LCP and PA9T
- Best weld line strength in its class
- Savings through cycle time reductions
- Heat and warp resistance competitive with liquid crystal polymer (LCP)
- Ability to increase mold cavitation
- Lower warpage in processing (flatter products)
- Higher permissible proportion of regrind without compromising on the UL V-0 rating

Property	Standard	Stanyl® 46HF5040	Stanyl® 46HF5050	Stanyl® 46HF5041LW
Density	ISO 1183 [g/cm³]	1.78	1.87	1.87
Stiffness	ISO 527-1 [GPa]	14.5	18.0	15.5
Strength	ISO 527-1 [MPa]	175	200	150
Elongation at Break	ISO 527-1 [%]	1.7	1.5	1.3
Impact Resistance *Notched Izod 23°C*	ISO 180-1A [kJ/m²]	12	19	11
Heat deflection *Temperature HDT/A*	ISO 75-1 [°C]	290	290	270
Mold shrinkage (parallel)	DSM [%]	0.3	0.3	0.2
Mold shrinkage (perpendicular)	DSM [%]	0.7	0.7	0.8
Flame-retardancy	UL 94 (class, thickness)	V-0 (0.4 mm)	V-0 (0.4 mm)	V-0 (0.4 mm)

* For designing parts greater than 0.5 mm in thickness that need to undergo a reflow soldering step, please seek guidance from the DSM Sales Office in your region.

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Astonishing Stanyl®