Stanyl® TW241F12

Stanyl® TW241F12 - Expands metal replacement design opportunities where part stiffness is the limiting factor

- Looking to replace a cast metal part with plastic and still keep its rigidity?
- Reached limit of part rigidity with current plastic materials for your design?
- Need a better finish for your high stiffness part?
- Looking for a flatter, more dimensionally stable high stiffness part?
- Need a high stiffness material that can still fill a long flow path tool?

Stanyl® TW241F12 provides solutions to all of the above problems. Its high stiffness is combined with excellent processing to give more flexibility in parts design than has previously been possible with a heat resistant resin. By replacing metal with plastic you can reduce the cost and weight of your part. And for the metal to plastic conversion, DSM has the engineering skills to help engineers effect the transition.

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New possibilities in cast metal replacement for high temperature applications

Where design requirements of part rigidity and size have not previously allowed plastic alternatives to cast metals, engineers can now consider a new option that significantly broadens their scope: Stanyl® TW241F12.

- Stanyl® TW241F12 allows components to be designed to have a higher rigidity and at the same time stay more compact and lighter in weight than was previously possible. Compared to die-cast aluminum, weight savings of 20-40% and cost savings of 20-30% can typically be realized.
- Stanyl® TW241F12 has the highest modulus of any high performance resin at temperatures above 150˚C (300˚F) and exceeds the next stiffest Stanyl® grade by 30%.
- Stanyl® TW241F12 processes as easily as standard Stanyl® TW200F6 and much better than any other high performance resin. It enables complex geometries with thin walls to optimize topology and results in rigidity that matches what die cast aluminum delivers.

Stanyl® is already the preferred material for replacing metals in high temperature applications because it offers:

- The best combination of flow, strength and toughness that allows complex parts to be designed and still be manufactured with the integrity required of high performance applications.
- Superior creep and fatigue properties compared to any other thermoplastic.
- Toughness, to withstand harsh conditions, that exceeds other high performance resins.
- High wear resistance and low friction compared to cast metals even after surface treatment.

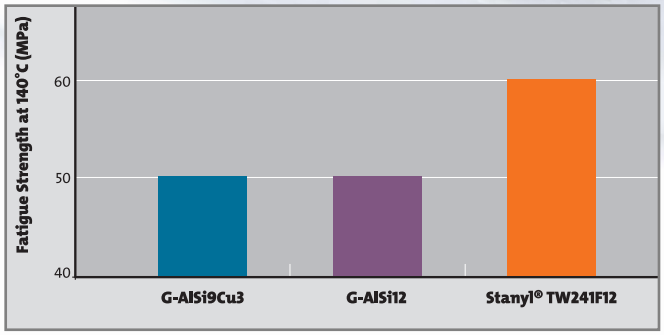
Stanyl® TW241F12 greatly broadens the scope to replace metal in applications at continuous use temperatures as high as 200˚C (392˚F) and with transient peaks of up to 250˚C (480˚F).

Stanyl® TW241F12 offers design engineers a reliable alternative to sand and die casting lightweight metal parts. Parts currently in metal can be designed to take advantage of the system cost reductions that come with high-speed injection molding, part consolidations, and elimination of secondary machining operations. Integrating a combination of cast metal parts into one molded Stanyl® solution can lead to even greater cost and weight savings.

Superior fatigue resistance to die cast aluminum @ 140˚C

Specific strength/stiffness of Stanyl® TW241F12 @ 140˚C

Material	Specific Stiffness kNm/kg	Specific Strength kNm/kg
TW241F12	5.8	68
Alu Alloys	24.8	10
Mg Alloys	22	35



Fatigue behavior at 140˚C and 10E7 cycles.

Stanyl® raises the bar over other high stiffness engineering plastics

Stanyl® TW241F12 has the highest stiffness at temperatures above 120°C (250°F) compared to other high heat resins with the same level of reinforcement and yet it processes more easily than a regular 30% glass reinforced resin. When compared to other high stiffness materials Stanyl® offers:

- Toughness over other high temperature resins
- Temperature capability to 200°C (390°F)
- Higher creep modulus (see figure 2)
- Excellent fatigue resistance (see figure 3)
- Easier processing
- Cycle time advantages up to 40%
- Better surface finish due to better flow
- Better stiffness between 140-250°C (285-480°F)
- Lower dependence on temperature in that range than any other engineering plastic

Stanyl® ensures greater safety margins for critical applications compared to other high performance resins like semi-aromatic PA (PPA) and PPS. PPA's have a higher modulus at room temperature, but they show a significant drop in stiffness at temperatures above 100°C (Table 1).

Table 1 Comparative properties at 160°C.

Material	Specific Stiffness kNm/kg	Specific Form factor Increase vs Stanyl
TW241F12	5.1	Reference point
PPA 60% GF	3.7	40%+
PPA 45% GF	2.8-3.3	50-100%
PPS 40% GF	2.8-3.6	60-100%

- Stanyl® TW241F12 requires lower injection pressures to fill a mold than other high stiffness materials, up to 50% less than similarly reinforced PPA's (Figure 4).

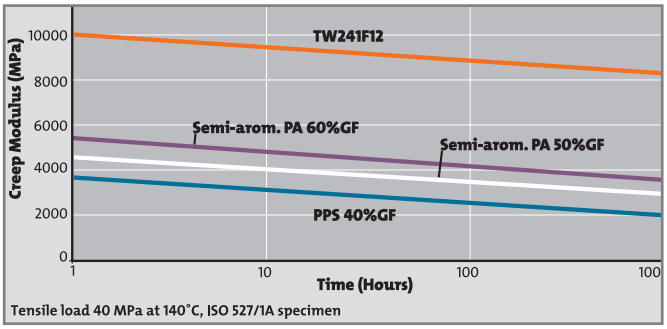


Figure 2 Creep modulus of glass fibre reinforced PA.

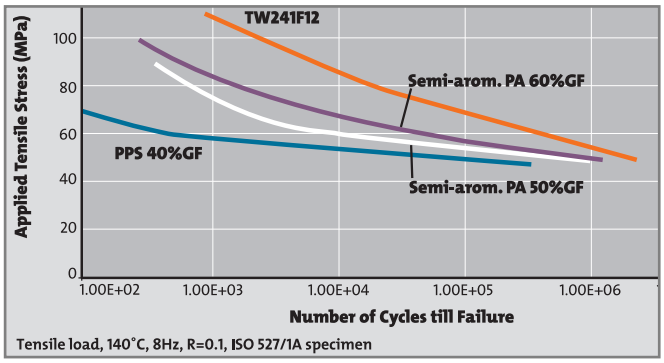


Figure 3 Fatigue resistance.

- Stanyl® TW241F12 can be used in smaller wall-thickness designs and high cavitation tools with less risk of mold damage compared to other high glass fiber loaded materials.

Stanyl®'s unique polymer structure and high crystallinity imparts to this grade superior property retention at temperatures over 120°C (245°F) and the high glass loading gives it a stiffness suited to the most demanding metal replacement challenges. Stanyl® TW241F12 surpasses the high temperature strength and stiffness of competitive High Heat Resins (PPA, PEEK, PPS, LCP) and standard engineering resins such as PA 6, 66 and polyesters.

Advantages of Stanyl® for metal replacement applications

Stanyl® TW241F12 allows for ease of processing and design

An important design attribute of Stanyl® is its excellent flow. This allows it to be used in precision molding, coping with intricate design and delicate molds, long flow lengths, thin walls, large plane surfaces, and insert molding. This capability serves a wide range of potential end markets as diverse and challenging as aerospace, information technology, electrical connectors, medical, and automotive.

Stanyl® flows significantly better (Fig. 4) than almost all other high temperature resins such as PPS and PPA's and even PA66, and Stanyl® TW241F12 has similar flow to lower stiffness grades of Stanyl® as a result of proprietary DSM technology. Despite a high glass fiber loading, processing is superior to PPS and PEEK. Although the flow of LCP's is similar, Stanyl®'s toughness, good weld line strength, and the low tool temperatures required make it a much easier material to process.

Using Stanyl® TW241F12 means you do not have to compromise with lower reinforcement levels to get a good surface finish. The high flow level for this reinforced material ensures it can be used for visual parts. Stanyl® TW241F12 avoids the use of carbon fibers to achieve high stiffness. This makes it affordable and maintains insulator properties. Coloring is also possible during molding, however pigments will affect properties and this should be allowed for.

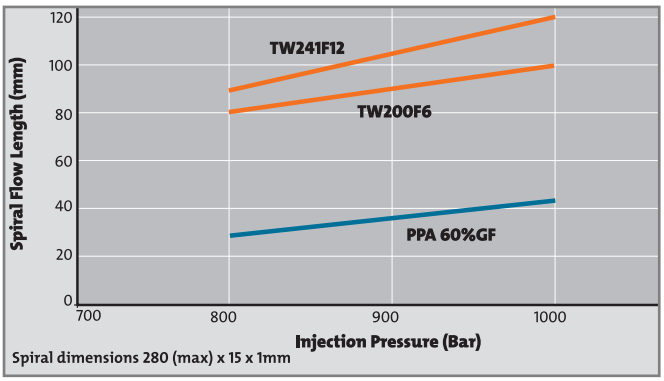


Figure 4 Stanyl® TW241F12 can fill molds that other highly filled resins cannot.

Parts made in Stanyl® TW241F12 make designing easier because they offer:

- More dimensional stability due to the high glass loading
- Low built-in stress due to the low injection pressures required
- Lower tendency to warp during post-molding relaxation

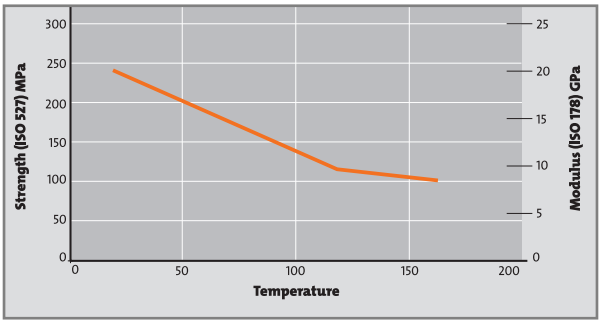
Engineering parts in plastic requires different techniques to those used when working with metals if the full benefits of plastics processing are to be realized. Your Stanyl® engineer is there to help optimize your plastic design so that it delivers the performance you require.

Stanyl® TW241F12

Key properties of Stanyl® TW241F12 at a glance

Mechanical	
Tensile elongation at break	2.0%
Izod Impact @ 23°C	15 kJ/m²
(ISO 180/1A) @ -30°C	11 kJ/m²
Physical	
Density	1.76 g/cm³
*CLTE, +23°C to +55°C	2 E-05 /°C
Thermal	
Melting Point	295°C (565
Heat Deflection Temp.@ 1.81 MPa	>290°C (ISO75)
Continuous Use Temp (2500 hrs)	190°C (555°F)

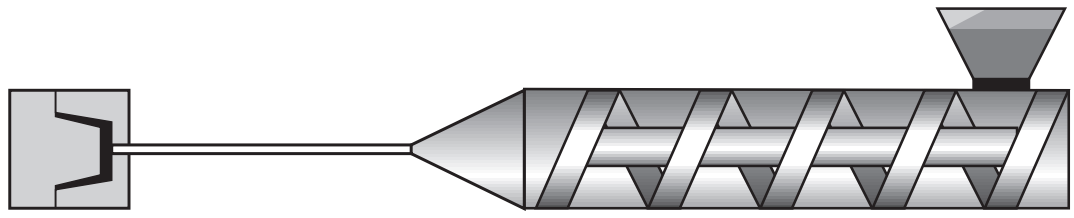
*(*CLTE = Coeff. of Linear Thermal Expansion)*



Tensile properties of Stanyl® TW241F12.

Processing guidelines for Stanyl® TW241F12

- For optimal mechanical performance and flow, the melt temperature should be around 325°C (615°F).
- For dimensional stability, a minimum mold temperature of 80°C (176°F) should be used.
- Use high temperature settings in the compression/ metering zone. Make sure the actual melt temperature is sufficient.
- High dosing speed, high screw speed, high injection speed.
- Low back pressure of approximately 10 bar hydraulic pressure (100 bar effective).
- Check drooling from nozzle; adjust nozzle temperature if necessary, but not too low. Use reversed tapered polyamide nozzle.



Stanyl®	Mold	Melt	Nozzle*	Front	Center	Rear
TW241F12	60-120°C (140-250°F)	315-330°C (600-625°F)	280-300°C (535-570°F)	315-330°C (600-625°F)	310-325°C (590-620°F)	280-310°C (535-590°F)

* The correct nozzle temperature should show a neat sprue end and no drooling from the nozzle. This temperature is usually 5 to 20 degrees lower than the actual polymer temperature. Be careful during the start-up for nozzle freeze-off.

Stanyl® TW241F12 enables engineers to reduce cost by replacing metal castings in high temperature applications

- Enables most compact, lightest weight plastic design for any required component stiffness
- Allows full exploitation of parts integration due to outstanding mechanical properties, leads to system cost reductions
- Productivity benefits unmatched by any other performance resin

Stanyl® replaces die cast aluminum for Polaris ATV sector gears.

Advantages of thermoplastics over metals:

- Freedom of design – more complex geometries, better use of space & part consolidations
- Integration of different attachment functionalities (e.g. snap-fits)
- Lower density = lower part weight
- No secondary machining operations
- Ease of assembling and welding (e.g.. vibration, ultrasonic, laser)
- Ease of processing
- Designing in plastics allows parts integration Fewer production steps in relation to metals
- No painting required, inherently corrosion resistant, maintenance free
- Longer part life and better aesthetics over the life of the part
- Insulation properties: electrical, thermal & noise
- Lower energy costs in production
- Lower tool cost & maintenance cost vs. die cast
- Can yield system cost savings of up to 80% depending on part size, numbers produced, design complexity and after-treatments previously required

Suitable Applications for Stanyl® TW241F12

Mechanical, loaded parts operating at high temperatures including:

- Transmission & rocker valve covers for HD trucks
- Chain tensioner base
- Charge air cooler end caps at higher temperatures
- Mounting brackets close to the engine

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Astonishing Stanyl®