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**THOMSON™**



Advancing Technologies.  
Perfecting Ball Screws.

WEDGES & DEEFS

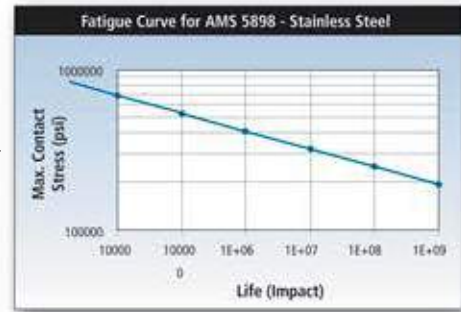
# ADVANCING TECHNOLOGIES. PERFECTING BALL SCREWS.



Aerospace and Defense is a key market segment for Thomson with \$500M per year in Aerospace and Defense business. Our history stretches from the first ball screw in an aviation application, Boeing B29 in 1939, to seeker gimbal stabilization in modern missiles.

More than anyone, we know that all ball screws are not alike. Thomson is the continuing source for the latest ball screw technologies. We have invested 70+ years in research and development, earning over 100 ball screw technology patents. Core strengths in ball screw design are energized with our global infrastructure and systematic excellence in manufacturing. This is why Thomson ball screws are your best choice for the aerospace and defense industry.

Presented here is an outline of materials used, design features and tangible benefits provided by Thomson ball screws.



## MATERIALS: Crafting the right stainless steel for the job

Expert metallurgists maintain the highest possible quality control standards, selecting the material best suited for a particular ball screw application. Our most popular stainless steel selections include:

TSS-NE98	Nitrogen alloyed stainless steel with excellent load/life characteristics and superior corrosion resistance
TSS-3165 and 3165A	High carbon martensitic stainless steel with great load/life characteristics (RC 60 hardness) and corrosion protection at a moderate cost
TSS-PR70	One of the most widely used precipitation hardening grades, characterized by excellent corrosion resistance and high toughness and strength
TSS-CP67 and LC62	Excellent corrosion resistance and good strength through hardened grading
TSS-LB63 and CC46	Martensitic stainless with increased load carrying capabilities and the ultimate in corrosion resistance



Customer defined cold/icing test



Milspec MIL-STD 810 sand/dust test

## WIPER TECHNOLOGY: Keeping it clean under all conditions

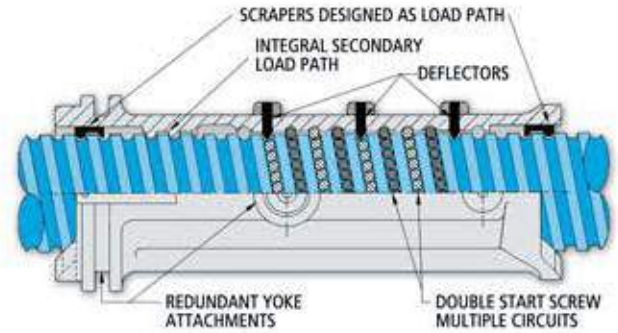
Thomson is the leader in ball screw wiper technology. Patented designs include multi-piece wipers/ice scrapers to thin section multi-directional lip seals. We use the best proven materials: Elastomers with nitrile compounds as well as Nylons and Teflons.

These compounds can also be tuned with selective fillers. We ensure compliance in even the harshest environments, help prevent contaminant ingress and, at the same time, protect and preserve the internal product features and lubricants.



## ADVANCED DESIGN: Redundant load systems for maximum reliability

Critical to superior ball screw design is the challenge of increasing reliability while keeping weight and envelope to a minimum. Thomson Ball Screws meet the challenge head-on with these built-in redundancy features.

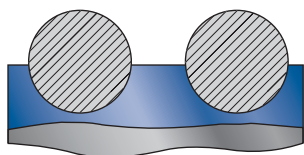


Multiple ball bearing recirculation circuits	Increases reliability – if one circuit fails the ball screw will continue to operate
Integral load bearing wiper/scraper elements	Designed to take up the load imparted by screw threads if the bearing balls become lost, severely damaged or worn
Latent, inert “male” thread path	Failsafe mechanism carries the load in case of bearing failure
Structural load tubes	Maintains the load capacity if the screw shaft is separated or severely damaged
Multi-start threads	Allows independent circuits of balls to operate in each path
Dual nut systems	Redundant supports promote long, safe operation
Fault locking mechanisms	Prohibits load carrying nut from free-falling down the screw should the nut lose its ball bearings

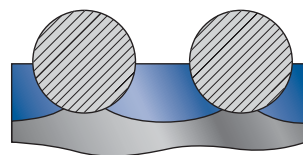
## HEAT TREAT TECHNOLOGY: Fine tuning design and materials

Thomson Ball Screws are optimized by accurately heat-treating selected materials to meet exacting customer needs. Thomson holds an industry leadership position, in part, by maintaining our own facilities for heat-treating and plating maintained by our own A2LA accredited metallurgical laboratory.

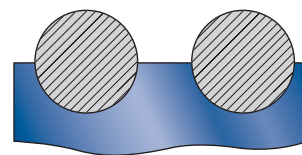
As a result we are better able to ensure product integrity, stabilize lead accuracy and suppress aging deformation. Ownership of these technologies enable us to perform selective case hardening for improved wear resistance without compromising structural resilience. Available heat-treating options include:



**Induction hardening**  
Creates a deep homogenous case



**Selective induction hardening**  
Yields a hard raceway with tough root and core



**Through hardening**  
For high alloy and precipitation hardening steels

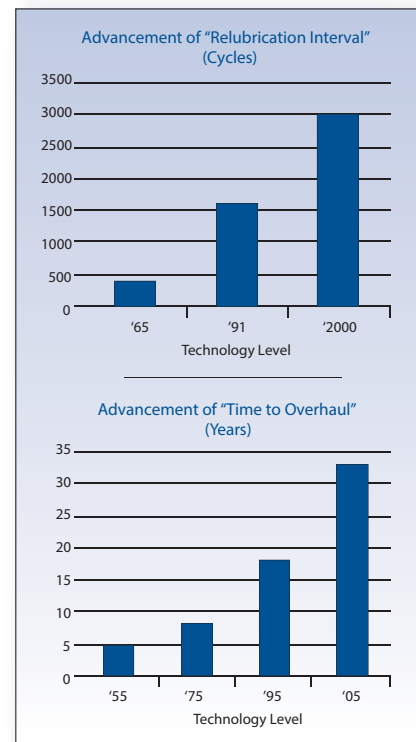


## REDUCED MAINTENANCE: Value added to each Thomson Ball Screw

Very important in Thomson Ball Screws design is the balance of form, fit and materials to promote ease of use and long life. Superior design combines with systematic excellence in our manufacturing processes to substantially reduce maintenance intervals.

Reduced maintenance is achieved by:

- Harder raceways for reduced wear
- Highest quality wiper and sealing systems
- Patented scraping systems to eliminate ice damage
- Internal ball re-circulation systems to minimize handling damage
- High technology lubricants for increased shelf life



## IMPROVED RELIABILITY: Decades of success

Reliability is critical for any actuation product. Superior reliability is one more reason why Thomson Ball Screws have been a first choice of aerospace design engineers for more than 70 years. We have a thorough understanding of the latest technologies and are motivated with a relentless pursuit of perfection.

Thomson's engineering expertise tops the industry. Our record speaks for itself, for example: a 2002 study covering several hundred million hours of primary flight control application, revealed Thomson Ball Screws were seven times more reliable than comparable industry norms.

## ENGINEERING CAPABILITIES: The best team with the right equipment

Thomson's engineering capability is without peer. Key to that capability is our staff of application and engineering professionals. We are passionate about recruiting, developing and retaining the best talent available – people who use their skills, creativity and integrity to develop innovative ways to meet customer needs.

The best team is equipped with state of the art design tools such as 3D CAD/CAM, FEA and Simulation, and rapid prototyping

functionalities in our laboratory, design and development facilities. We remain keenly attuned to actual field service experience through our FAA certified repair station with over 15,000 ball screw condition reports on file.

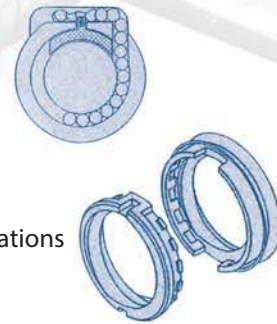
We are able to respond to your unique application challenges in a timely fashion with accurate, cost effective proposals complete with specifications, product detail, and appropriate analysis.



## HISTORIC FOUNDATIONS

The Thomson brand is known the world over as the leading supplier of linear motion technologies. We are proud of our rich tradition of “firsts in the industry,” including:

- Ball screw in aviation application, 1939, Boeing B-29
- Multi-extend telescoping screws
- Chrome plating and other special coatings
- Multi-piece redundant load carrying wiper/scrapper elements
- Multi-redundancy load bearing elements for improved reliability
- Lightweight titanium and other special materials for weight critical applications
- First engine pylon conversion actuator, with redundant multi-extend
- More than 100 patents dedicated strictly to ball screw technology



## MODERN SOLUTIONS

Thomson Ball Screws are found in a variety of aerospace and defense applications from flap/slat actuation on the B-1 and C-5 to canopy actuation on the F-22. Other current applications include rocket launchers, smart directed munitions, armored tank turrets, communication dishes and many commercial aviation products.

Our latest technology ball screws expand their proven track record of performance to withstand the most vigorous demands of today's aerospace and defense industries.





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