

# TORX PLUS DRIVE SYSTEM

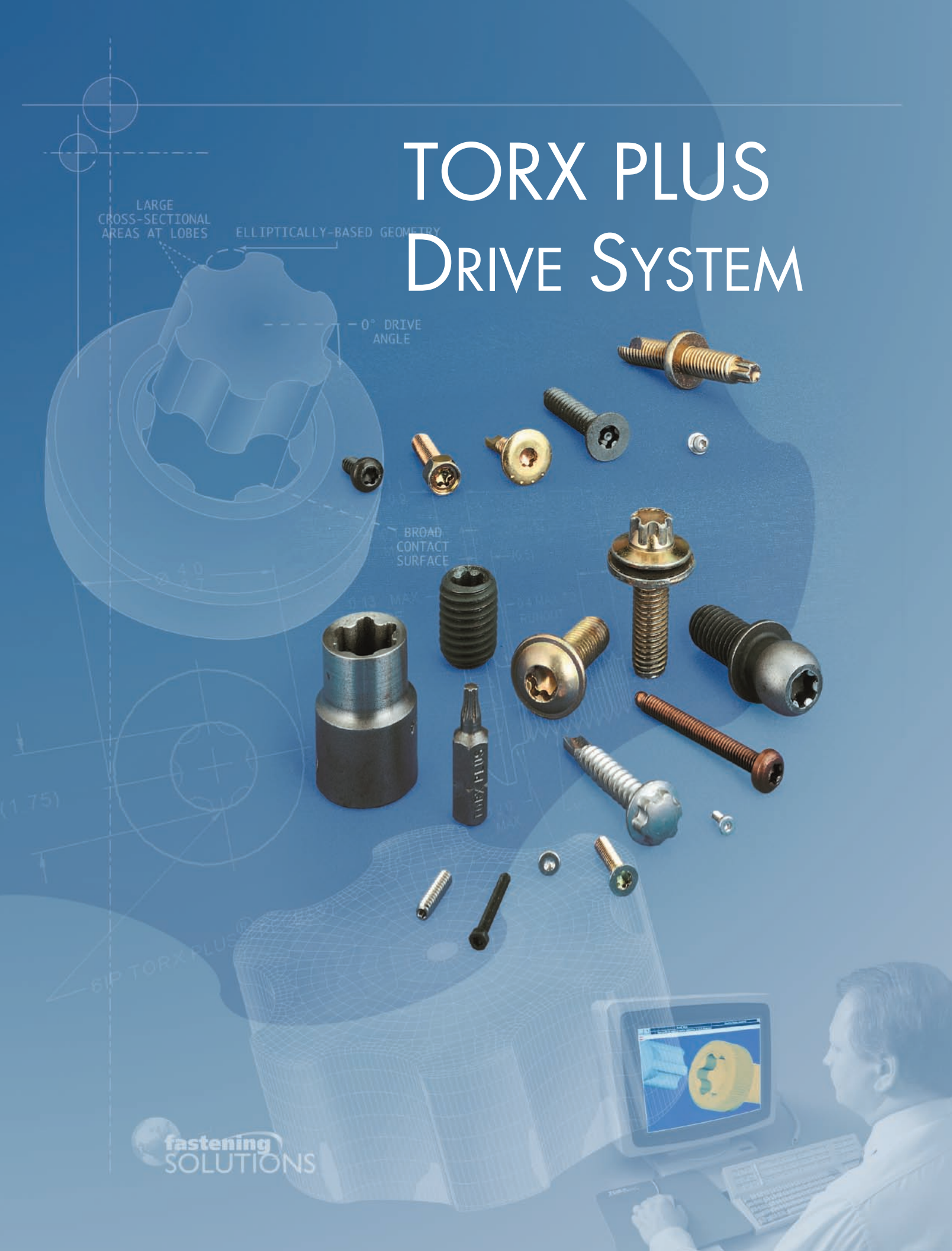
LARGE  
CROSS-SECTIONAL  
AREAS AT LOBES

ELLIPTICALLY-BASED GEOMETRY

0° DRIVE  
ANGLE

BROAD  
CONTACT  
SURFACE

fastening  
SOLUTIONS



# HOW IMPORTANT IS YOUR DRIVE SYSTEM?

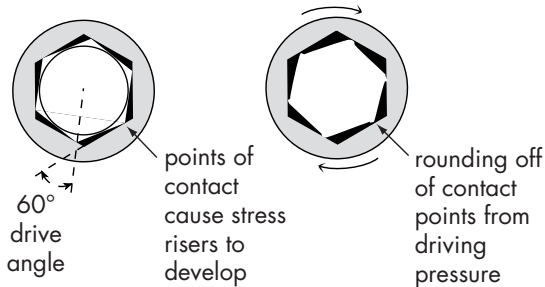
The fasteners you use in your product may seem insignificant, but they are an important factor in your overall productivity, quality and profitability. The drive system on those fasteners affects assembly speed, downtime, worker comfort, and the amount of reworked and/or scrapped components, as well as product design.



## WHY OTHER DRIVE SYSTEMS CAUSE PROBLEMS ON THE ASSEMBLY LINE

### HEX

- point contact causes stress risers to develop, which damages driver bit and fastener recess
- 60° drive angle is inefficient in transferring torque

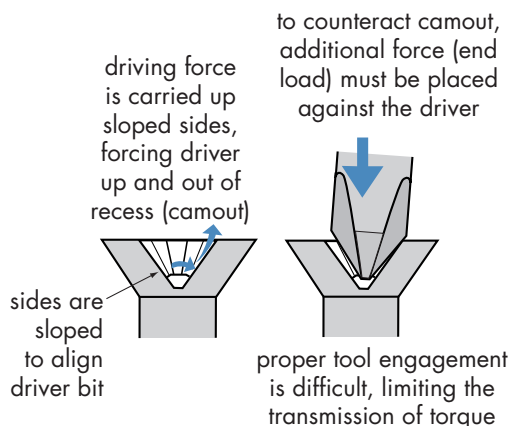


Tool and fastener damage is common

### CRUCIFORM

(includes Phillips, ACR® Phillips II and Pozidriv®)

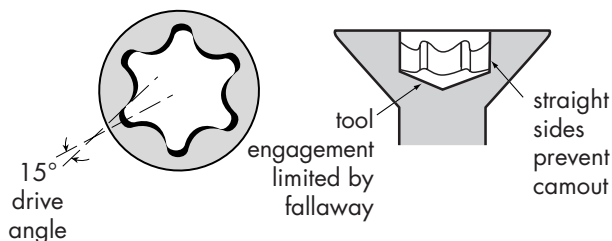
- Camout, which forces the drive tool out of the recess, is common
- Camout and its limits on torque transfer can prevent a fastener from being fully seated
- Excessive end-load, required to prevent camout, can reduce bit life and cause worker fatigue or injury
- Camout and tool/recess wear can create debris in an application



Concentrated stresses can cause breakage

### TORX® DRIVE

- Allows higher torque transmission
- 15° drive angle still permits a small amount of radial stress, which can reduce bit life
- Tool may be difficult to align properly in high-speed assemblies



Wide tolerances can result in a loose fit between fastener and tool bit

# THE SOLUTION TO YOUR ASSEMBLY PROBLEMS

Since its introduction, TORX PLUS® Drive has consistently outperformed every other drive system. Its longer tool life and optimal torque transfer have enhanced product reliability, increased productivity, and reduced total assembly costs on assembly lines in a multitude of industries around the world.

## Elliptically-based Geometry

- Broadens contact surface to maximize engagement of driver and recess
- Eliminates damaging point-to-point contact

## 0° Drive Angle

- Optimizes torque transmission
- Virtually eliminates radial stresses to increase tool bit life
- Allows use of thinner-walled recesses

## Six Lobes With Large Cross-Sectional Areas

- Allows faster tool engagement
- Maximizes torque transfer
- Increases torsional strength

## Vertical Sidewalls & Reduced Recess Fallaway

- Increases tool engagement
- Virtually eliminates camout
- Ensures proper torque transfer
- Greatly reduces end load requirements
- Minimizes tool slippage and damage it can cause
- Can reduce fatigue and muscular stress during manual assembly of fasteners

## Greatly Increased Strength and Reliability

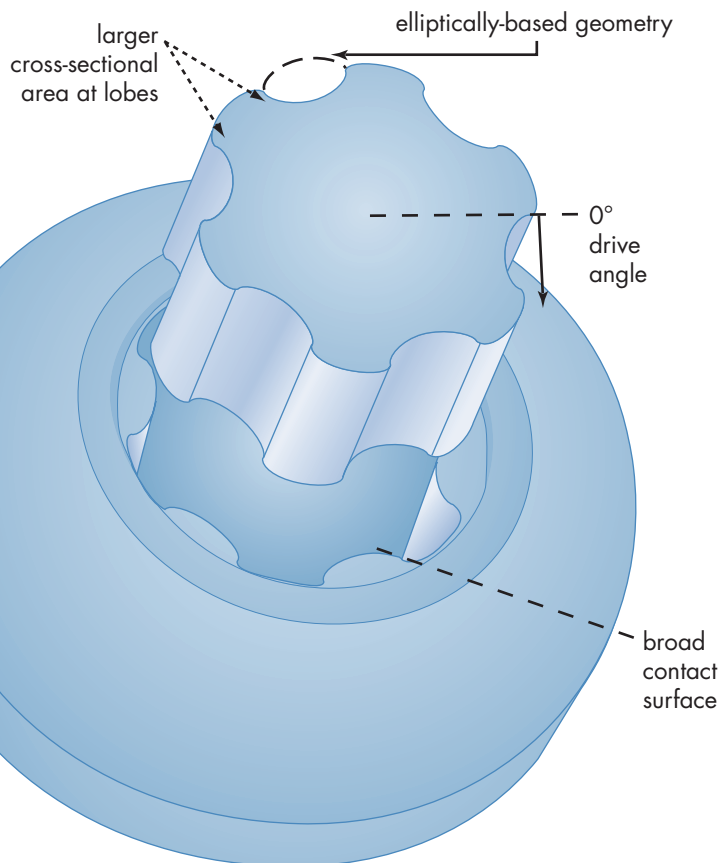
- 100% average improvement in driver bit life; many users of the TORX PLUS Drive System have driven 2 to 10 times more fasteners per drive tool
- 25% average improvement in driver bit torsional strength
- Increased bit strength allows for higher removal torque capability

## Inch & Metric In One Drive Tool

- Same-sized drive tool seats both inch- and metric-sized fasteners
- Add or convert to metrics without a tooling change
- Reduce the number of tools required by field service personnel

## Compatible with TORX® Drive for Field Service

- TORX Drive tools can be used to remove and reinstall TORX PLUS Drive recess fasteners



# TORX PLUS® DRIVE SOLVES ASSEMBLY PROBLEMS



Perhaps you have come to accept frequent tool bit changes, camout, damaged components and slowed assembly lines as a cost of using fasteners in your product. But it doesn't have to be that way.

The TORX PLUS® Drive was designed to enhance assembly line performance. Manufacturers all over the world have realized significant improvements and cost savings by switching to the TORX PLUS Drive.

## Most Common Fastener Driving Problems\*

Camout and tool slippage: 71%



Poor tool/fastener engagement: 44%



Excessive tool wear: 23%



Achieving desired clamp load: 24%



Fastener drive wear: 21%



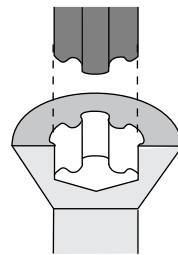
Worker fatigue: 17%



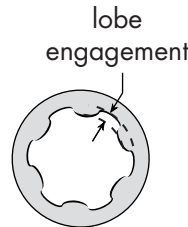
Excessive end load requirements: 8%



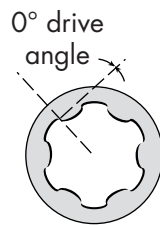
## TORX PLUS® Drive SOLUTIONS



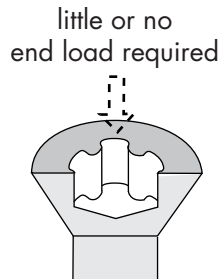
The straight, vertical sidewalls of the TORX PLUS Drive System **virtually eliminate camout**. Also, the TORX PLUS recess completely encloses the driver tip, **reducing tool slippage** as well as costly and unsightly damage to the fastener and surrounding surfaces.



The elliptically-based geometric configuration of the TORX PLUS Drive System **maximizes engagement** between driver and fastener. It spreads driving forces over the surface area, **extending tool life**.



TORX PLUS Drive is the only drive system designed to **ensure optimum torque transmission** and, ultimately, required clamp load. With a true 0° drive angle, the TORX PLUS system virtually eliminates the radial forces that can cause stress on fastener recesses.

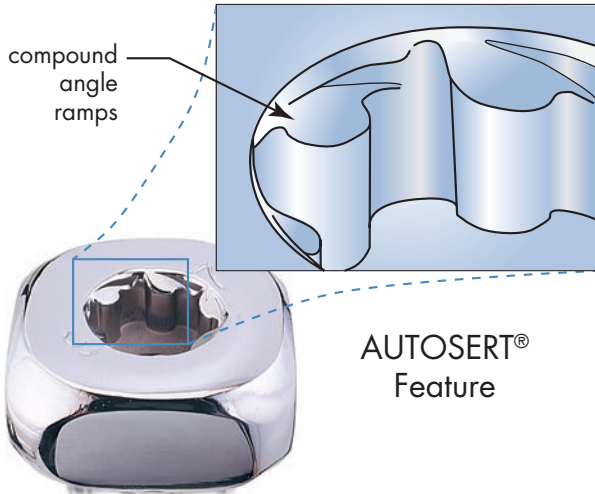


Ergonomic studies demonstrate that the TORX PLUS Drive System can **reduce fatigue and muscular stress** during the manual assembly of fasteners. That's because little or no end load is required to keep the driver engaged in the recess.

\*Results of a Design News/Cahners Research study on fastener drive styles, published March 1998. Respondents were design engineers involved in product or system design.

# PERFECT FOR HIGH-SPEED ASSEMBLY LINES

The AUTOSERT feature is the perfect solution for assembly situations where the driver bit is continuously rotating.



Difficulty in aligning the drive bit and the recess can force an assembly line to slow down to assure proper fastening.

## AUTOSERT® FEATURE – THE HIGH PRODUCTIVITY ANSWER TO HIGH RPM ENGAGEMENT

The compound angle ramps of the AUTOSERT feature guide the driver bit into the recess, creating a self-centering and engaging action. It's the perfect solution for automated, robotic and other assembly situations where the driver bit is continuously rotating.

- Allows for higher rpm engagement
- Speeds engagement
- Reduces assembly time
- Increases productivity

Enlarged window of engagement improves drive bit alignment in offset and off-angle conditions

- Eases starting
- Eliminates need to slow down driver bit

### Lobe Engagement

- Increases tool life – during beta site testing, a manufacturer achieved reduced drive bit usage at over 1500 rpm
- Eliminates camout debris

This patented feature is a TORX PLUS Drive exclusive, available in drive sizes 6IP-100IP

## TORX PLUS DRIVE SOLUTIONS REDUCING INSTALLATION TIME & DRIVE BIT USAGE

APPLICATION: Truck trailer floor

FASTENER DESCRIPTION: 5/16-18 Taptite® thread-forming screw

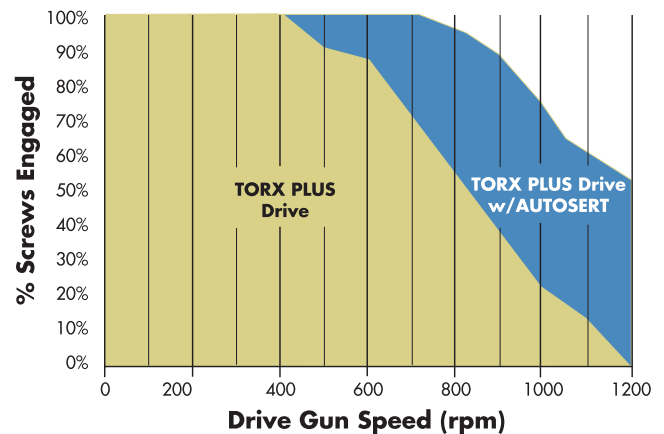
ASSEMBLY METHOD: Manual stand-up, two-hand drive gun whose bit continuously spins at 2,200 rpm

ASSEMBLY PROBLEM: When using TORX Drive, assembly line had to be slowed down to assure proper drive bit/recess engagement.

TORX PLUS DRIVE SOLUTION: TORX PLUS Drive with AUTOSERT feature allows drive bit to remain at full speed when engaging fastener, increasing productivity.

### CUSTOMER BENEFITS:

- Installation time was reduced as much as 20 minutes per trailer
- Drive bit usage was reduced from 45 bits per week to less than 5 per week



Laboratory testing reveals 100% of recesses using AUTOSERT feature were engaged with TORX PLUS Drive bits rotating at 700 rpm.

# TORX PLUS® DRIVE LOWERS IN-PLACE COSTS

## LONGEST TOOL BIT LIFE AVAILABLE



The elliptically-based geometry of the TORX PLUS Drive System maximizes lobe engagement between driver and fastener, spreading driving forces over its surface area. This extends tool life and maximizes torque transfer.

In test after test, on assembly line after assembly line, the TORX PLUS Drive has been proven to significantly outlast all other drive systems.

## REDUCES ASSEMBLY LINE DOWNTIME

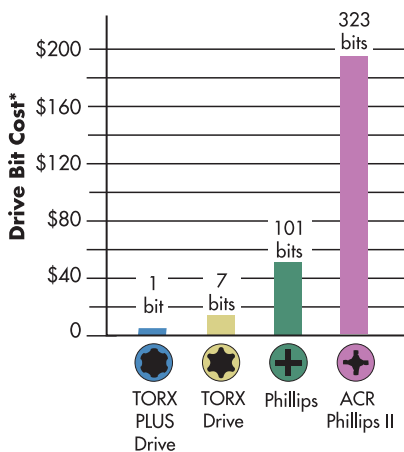
One of the most overlooked assembly line costs is downtime. Every time a fastener drive bit fails, the line has to be shut down to change the bit. Over time, line downtime can have a significant negative impact on productivity and profitability.

Many customers who have switched to the TORX PLUS Drive are reporting that they have been driving 2 to 10 times more fasteners per bit.

## REDUCES ANNUAL DRIVE TOOL COSTS

Although a single TORX PLUS Drive bit or socket may cost more than competing systems, its longer life translates into more assemblies per bit and significantly lower overall tooling costs.

**Cost to Fasten 150,000 Fasteners\***



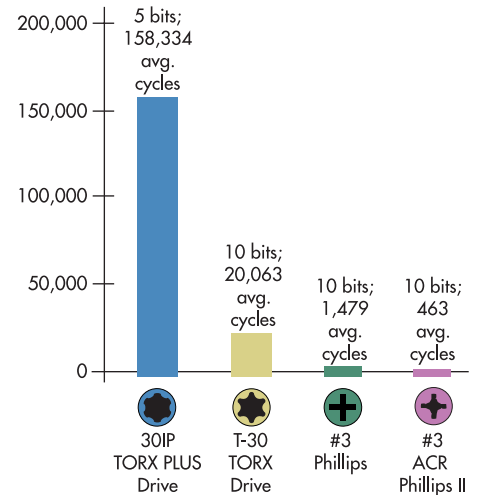
Using fewer drive bits reduces costs and downtime

\*The costs above reflect the the number of bits each system would need under the conditions of the Drive Durability Test described above.

## Drive Durability Test Results

Average Number of Fasteners Driven Per Drive Bit

TORX PLUS Drive is proven to significantly outlast the competition



Note: Various drive systems compared with a dedicated automated driving machine. M6 x 1.0, pan head, Class 10 fasteners driven at 330 rpm to 15Nm with 13.3 Newtons end load. All failure modes were bit fracture.

## TORX PLUS DRIVE SOLUTIONS

DRIVE BIT COSTS REDUCED BY \$15,000 ANNUALLY

APPLICATION: Automotive air suspension system

ASSEMBLY METHOD: Automated assembly line utilizing a 4-position, multi-spindle driving station to drive Plastite® fasteners

ASSEMBLY PROBLEM: Customer replaced their four Phillips drive bits three to six times per day over three shifts. This resulted in assembly line downtime in addition to the costs of replacing 12 to 24 bits per day.

TORX PLUS DRIVE SOLUTION: The first TORX PLUS bits were replaced after four months of use, and then only as a precautionary measure. The customer noted that the bits were hardly worn and could have lasted much longer.

CUSTOMER BENEFITS:

- Lowered drive tool costs by \$15,000 annually
- Reduced assembly line downtime due to fewer drive bit changes
- Improved productivity



# TORX PLUS® DRIVE BENEFITS PRODUCT QUALITY

## ACHIEVES PROPER CLAMP LOAD

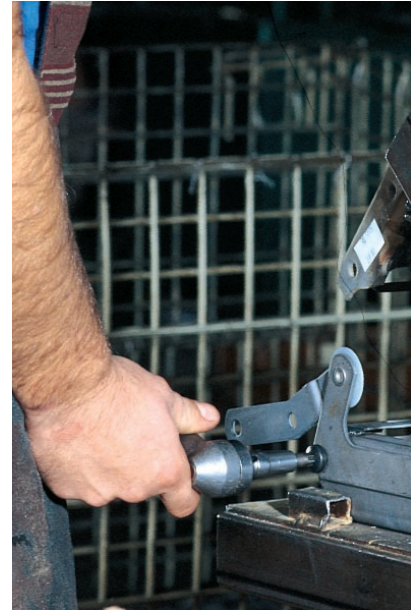
If the proper clamp load isn't reached, or if camout forces a driver out of the recess before it is fully seated, the fastened joint can easily loosen. This can lead to leaks, squeaks, rattles or even complete joint failure, which may require service in the field and result in higher warranty rates.

TORX PLUS Drive is the only drive system designed to ensure optimum torque transmission and, ultimately, required clamp load.

## MINIMIZES REWORK

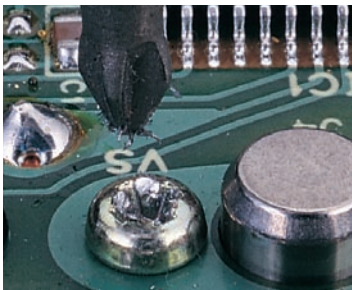
Poor torque transfer due to drive bit wear can result in a poorly built component that needs to be disassembled, reworked, and reassembled, which adds labor as well as material costs. Scrapped rejects – components that cannot be reworked – represent wasted costs.

The longer bit life of the TORX PLUS Drive helps ensure that proper torque transmission occurs consistently.



## PREVENTS DAMAGE TO APPLICATION

If tool slippage or camout forces the driver out and across a component, damage to the surrounding surfaces, such as scratches and dents, can occur. TORX PLUS Drive recesses completely enclose the driver tip, preventing tool slippage. That design feature, along with minimal camout, means the TORX PLUS Drive bit will stay where it belongs, preventing damage to itself, the fastener recess, and the application.



Camout and tool/recess wear can also create damaging debris. This diminishes the aesthetic value of the fastener, and, more importantly, can cause irreparable damage in electronic assemblies, airbags, and other critical applications.

The longer life of the TORX PLUS Drive minimizes tool and fastener wear, and its straight sidewalls virtually eliminate camout. That makes the TORX PLUS Drive the optimal drive system for every application.

## REDUCES WORKER FATIGUE AND MUSCULAR STRESS

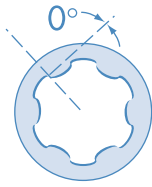
Workers can experience fatigue and muscular stress during the manual assembly of cruciform or slot drive fasteners, caused by the pressure they must exert to keep the driver engaged in the recess (end load) This can lead to reduced productivity or even injuries.

Ergonomic studies demonstrate that the TORX PLUS Drive System can reduce fatigue and muscular stress during the manual assembly of fasteners. That's because little or no end load is required to keep the driver engaged in the recess.



# TORX PLUS® DRIVE ENSURES OPTIMAL TORQUE TRANSFER

## DESIGNED FOR HIGH TORQUE TRANSMISSION



Unlike the inefficient designs of other systems, TORX PLUS Drive is the only drive system designed to ensure optimal torque transmission. With a true 0° drive angle, the TORX PLUS system virtually eliminates the radial forces that can cause stress on fastener recesses.

The high torque transfer capabilities of TORX PLUS Drive means it can utilize increased seating torques without increasing current bit usage levels.

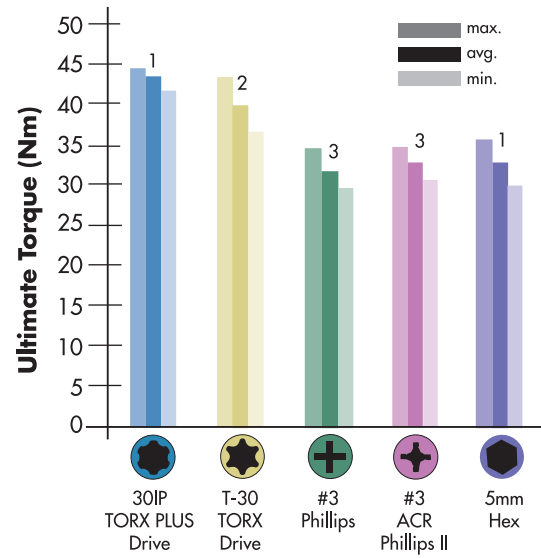
High torque transfer capabilities are also important during removal of a fastener in service environments, where corrosion can cause seizing in the joint.

## TORX PLUS BIT STRENGTH

Drive Size	Min. Torsional Strength	
	Lbs./Inch	Nm
1IP	0.96	0.11
2IP	1.41	0.16
3IP	2.50	0.28
4IP	3.87	0.44
5IP	5.37	0.61
6IP	9.83	1.11
7IP	18.60	2.10
8IP	28.40	3.21
9IP	37.10	4.19
10IP	48.00	5.42
15IP	85.10	9.62
20IP	143.00	16.10
25IP	208.00	23.50
27IP	306.00	34.62
30IP	418.00	47.20
40IP	726.00	82.10
45IP	1,216.00	137.40
50IP	1,722.00	194.50
55IP	3,116.00	352.10
60IP	5,011.00	566.20
70IP	8,058.00	910.40
80IP	11,422.00	1,290.50
90IP	17,036.00	1,924.80
100IP	23,412.00	2,645.20

NOTE: For optimum bit life, we do not recommend exceeding 50% of minimum torsional strength.

## Ultimate Torsional Strength Test



In this test, the head of each fastener was held fixed, then driven until either the drive bit or the recess failed:  
 1 - recess ream    2 - bit fracture    3 - camout

NOTE: M6 x 1.0, pan head, Class 10 fasteners driven at 8 rpm with 35.6 Newtons end load, at 0° off angle. The head was held fixed.

## TORX PLUS DRIVE SOLUTIONS PRODUCTIVITY AND ASSEMBLY QUALITY IMPROVE

APPLICATION: Refrigeration compressors

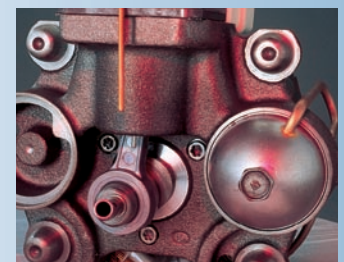
ASSEMBLY METHOD: Automated assembly line

ASSEMBLY PROBLEM: An internal hex fastener was causing excessive line stoppage due to the number of drive bit changes – the manufacturer was able to fasten only 8,000 screws per hex bit. Also, a large number of assemblies had to be rejected when the hex bits were unable to reach proper torque levels.

TORX PLUS SOLUTION: With the TORX PLUS Drive System the customer was able to fasten over 500,000 TORX PLUS fasteners with a single bit, and the proper torque levels were easily reached.






CUSTOMER BENEFITS:

- Lower drive tool costs
- Fewer drive tool changes
- Improved productivity and reduced downtime
- Reduced rejected assemblies
- From 8,000 screws fastened per bit to over 500,000





# TORX PLUS® DRIVE SURPASSES THE COMPETITION

DRIVE SYSTEM BENEFITS	 SLOTTED	 HEX	 CRUCIFORM	 TORX DRIVE	 TORX PLUS DRIVE
Minimizes tool slippage		•		•	•
Appropriate for automated assembly		•	•	•	•
Maximizes tool engagement					•
Drive angle	na	60°	na	15°	0°
Broad contact surface				•	•
Minimal camout		•		•	•
Minimal end load requirements		•		•	•
High torsional strength (over 40Nm)		• (external)		•	•
Reduces radial stress					•
Lengthens tool bit life					•
Tooling readily available	•	•	•	•	•

What is your most annoying fastening problem? Damaged applications? Constantly changing tool bits? Perhaps your current system solves one problem, only to cause another.

Only the TORX PLUS Drive gives you all the benefits you need to have a more efficient, more productive assembly line.



## USING TORX PLUS® DRIVE BENEFITS YOUR ENTIRE ORGANIZATION:

### PURCHASING

- Reduced tooling costs
- Reduced overall costs



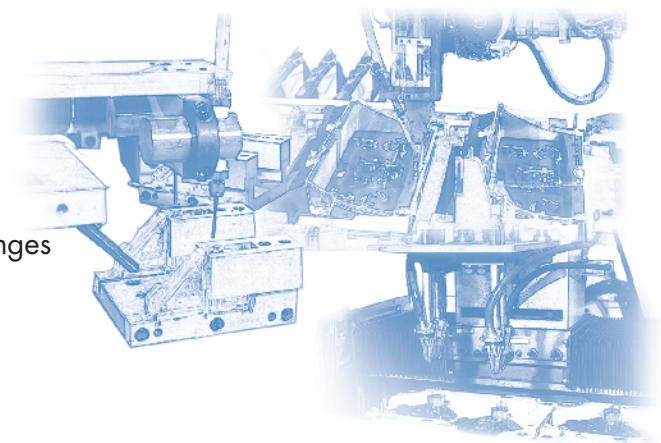
### MANUFACTURING

- Reduced downtime from tooling changes
- More assemblies per shift
- Reduced worker fatigue



### QUALITY CONTROL

- Ensures proper seating of fasteners
- Reduced field service and warranty claims due to improperly seated fasteners
- Reduced number of scrapped or reworked components



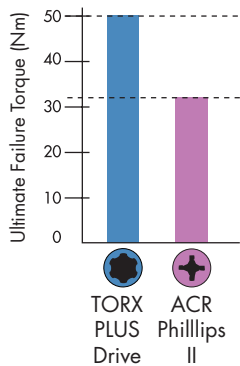
# TORX PLUS® DRIVE OUTPERFORMS ACR® PHILLIPS II

A finite element analysis of the TORX PLUS® Drive System and the ACR® Phillips II drive was conducted to analyze the amount of stress encountered by both the driver bit and recess when subjected to certain loads. The results:

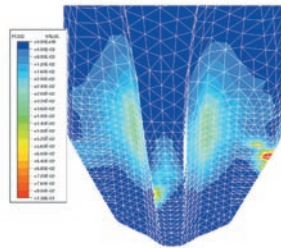
## THE TORX PLUS DRIVE HANDLES SIGNIFICANTLY HIGHER TORQUE THAN THE ACR PHILLIPS II

### Ultimate Torque

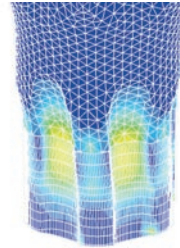
(force at which the driver fails)



### Driver Bits at Proof Load of 32 Nm



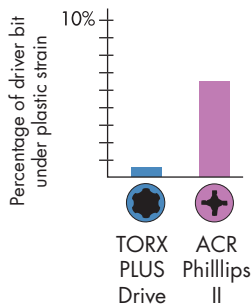
ACR II Phillips showed high levels of plastic strain (shown in red) concentrated in very small areas of the driver bit. These highly localized strains are initiation points for cracks on the driver.



The plastic strain levels in the TORX PLUS driver are lower and spread out more, so there is less chance the driver bit will crack.

## THE TORX PLUS DRIVER PROVIDES A LONGER FATIGUE LIFE THAN THE ACR PHILLIPS II

### Driver Fatigue at Proof Load of 20Nm



The ribs of the ACR Phillips II driver initiate stress risers. At 20Nm, this causes the plastic strains in the driver to be very large (6.0%).

At the same load, the TORX PLUS Drive bit has a very low percentage of plastic strain (0.5%).

Plastic strain causes permanent deformation to the driver that can shorten its life.



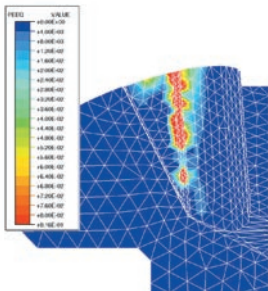
The ribs of the ACR Phillips II bit initiate stress risers



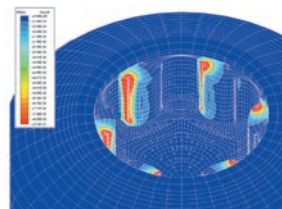
The curved surfaces of the TORX PLUS drive prevent stress risers

## THE TORX PLUS DRIVE FASTENERS OFFER AN INCREASED NORMAL OPERATING LIFE

### Fastener Recesses at Proof Load of 20Nm



Plastic strains on the ACR Phillips II fastener recess are fairly high and concentrated on the engaged rib. This will cause a similar result to what happens to the driver, with small cracks forming at these localized strain locations. If these cracks damage the protective coating of the fastener, it can allow corrosion which may reduce the normal operating life of the fastener.



Plastic strains in the TORX PLUS fastener recess are almost three times lower and much more spread out. Although some permanent deformation does occur, the stress is spread out, so there is less chance of cracks forming.

On all analyzes, the materials for both the TORX PLUS and ACR Phillips II models represented standard steel with values equal to a Property Class 10.9 fastener.  
NOTE: All drawings are representative of actual FEA results.

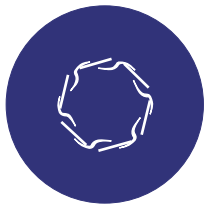
# TORX PLUS® DRIVE OUTPERFORMS THE TORX® DRIVE

A finite element analysis (FEA) of the TORX PLUS Drive System and the TORX Drive System was conducted to analyze the amount of stress encountered by both the drive bits and recesses.

The TORX PLUS Drive System demonstrated:

- An average 25% increase in ultimate torsional strength of the driver bit.
- An average 25% increase in ultimate torsional strength of the total drive system, allowing for higher torque transfer and higher torque removal capability.
- An increase in fatigue life averaging 100% because of reduced stresses in the driver bit.
- Because of the circumferential load transfer of the TORX PLUS Drive System, the radial stresses are greatly reduced. This allows for thinner-walled recesses and demonstrates a more efficient drive system.

## Force Vectors at 40Nm



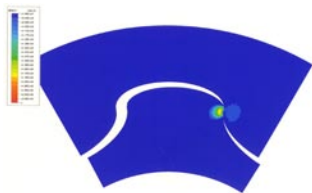
TORX PLUS Drive



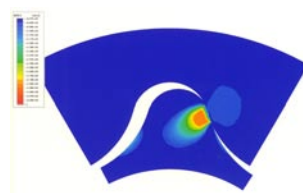
TORX Drive

The TORX PLUS Drive directs the forces in a more circumferential direction than the TORX Drive. Less force is passed into the fastener head and instead is utilized directly in rotating the fastener, resulting in a more efficient transfer of torque. This also allows thinner-walled recesses to be utilized.

## Transmitted Forces at 20Nm



TORX PLUS Drive

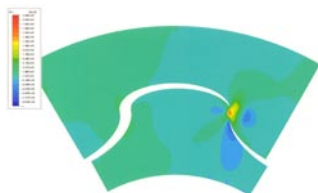


TORX Drive

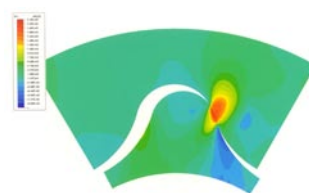
At 20Nm, the TORX PLUS Drive has a very small percentage of the drive bit under stress, and no sign of internal yielding.

The TORX Drive bit has a much higher percentage of the drive bit affected by the combined stresses (torsional, tensile, etc.) and also shows a small region that has internal yielding.

## Radial Stress at 20Nm



TORX PLUS Drive



TORX Drive

The TORX PLUS and TORX designs show a similar radial stress value at the point of contact. However, the radial stresses for the TORX Drive System spread farther into the fastener recess over a larger area than the TORX PLUS Drive System.

In fact, the radial stresses in the head quickly dissipate to zero for the TORX PLUS Drive System.

NOTE: The materials used for the TORX and TORX PLUS models were a typical thru hardened quench and tempered carbon steel, with properties representative of a Property Class 10.9 fastener. The material properties for the drive bit are for a modified S-2 material corresponding approximately to a hardness of Rockwell C60.

# TORX PLUS® DRIVE VARIATIONS

## TAMPER-RESISTANT TORX PLUS DRIVE

This unique TORX PLUS variation incorporates a five lobe design and a solid post formed in the center of the recess.

- When combined with a countersunk or button head design, the fastener is extremely difficult to remove without a special tamper-resistant TORX PLUS Drive tool
- Tamper-resistant TORX PLUS tooling is only available to the OEM and their authorized service technicians to limit access and maintain the integrity of the system
- Installation is quick and easy with the proper tool
- Recognized as the only truly tamper-resistant drive system – the preferred internal drive system defined in SAE specification J2317 (Tamper Resistance for Adjustable Parameters on Diesel Fuel Injection Pumps)
- Available in fastener sizes M2.5 – M25 (#3 to 1")



## DUAL DRIVE SYSTEMS

The TORX PLUS Drive System can be combined with either an external hex or a slot to provide a dual drive system.

- Provides the option of driving or removing the fastener with commonly available TORX PLUS tools or with a hex socket or slotted screwdriver
- The slotted TORX PLUS fastener has a slot that is enclosed at the ends, so the driver is less likely to slip out and damage surrounding surfaces

## EXTERNAL TORX PLUS DRIVE SYSTEM

Designed with the same elliptically-based geometry as the internal drive system, this version allows the highest torque transfer available.

- The external TORX PLUS Drive provides 10% more torsional strength than the same-sized external TORX Drive
- TORX PLUS sockets are required for installation and removal, as TORX sockets are not compatible
- Available in fastener sizes M0.6 – M24 (#0000 – 1")



## TORX PLUS STEM FASTENERS

An external TORX PLUS configuration, extruded onto one end of the double-end stud, simplifies driving.

- Eliminates need to grip threads during driving, preventing thread damage
- Offers improvement in stem strength due to increased cross-sectional area

## EXTERNAL TORX PLUS LOW-PROFILE HEAD

This version provides high torque transfer in a low head height.

- Higher torque transfer capabilities than corresponding internal recesses
- Head height similar to pan or indented hex head
- Lower weight than pan or indented hex head fasteners
- Requires special sockets
- Available in fastener sizes M0.6 – M24 (#0000 – 1")



# USING THE TORX PLUS® DRIVE



## VIRTUALLY ANY FASTENER DESIGN CAN INCORPORATE THE TORX PLUS DRIVE SYSTEM

With a wide range of styles and sizes available, the TORX PLUS Drive System is easy to integrate into your existing products as well as your new product designs.

We've also made it easy to convert your assembly line and service departments to the TORX PLUS Drive:

### INCH AND METRIC IN ONE DRIVE TOOL

The same sized TORX PLUS driver is used on both inch and metric fasteners. You can change to the TORX PLUS Drive now, and add or convert to metrics later without any tool changes. This can also reduce the number of tools required by field service personnel.



## TORX PLUS DRIVE SOLUTIONS IMPROVED ENGAGEMENT INCREASES PRODUCTIVITY

APPLICATION: Cellular telephones

ASSEMBLY METHOD: Automated assembly line utilizing a six-position, multi-spindle driving station

ASSEMBLY PROBLEM: Needed improved fastener engagement, increased productivity and to overcome misalignment of drive tool and recess common with TORX Drive.

TORX PLUS SOLUTION: TORX PLUS Drive with the AUTOSERT feature allowed their automated robots to more easily engage the fastener with less drive bit and recess damage.

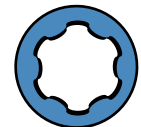
### CUSTOMER BENEFITS:

- Improved productivity
- Autosert feature allowed quicker, easier engagement of the drive bit
- Reduced drive tool usage
- Proper installation ensured through reduced damage to the fastener recess



## NO NEW SERVICE TOOLS REQUIRED

TORX PLUS Drive fasteners can be removed with either a TORX Drive tool or a TORX PLUS Drive tool, both commonly available at outlets around the world. However, to take full advantage of the benefits of the TORX PLUS Drive, TORX PLUS Drive tools are required.



TORX PLUS Drive bit in TORX PLUS Drive fastener



TORX Drive bit in TORX PLUS Drive fastener

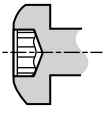
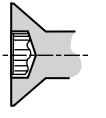
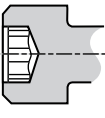
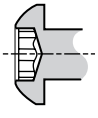
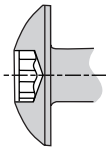
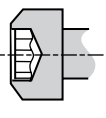
## TORX PLUS TOOLING IS EASY TO FIND

TORX PLUS Drive tools are available in a variety of styles at outlets around the world. With tooling licensees located in North America, Europe and Asia, specially-designed tooling is also readily available.

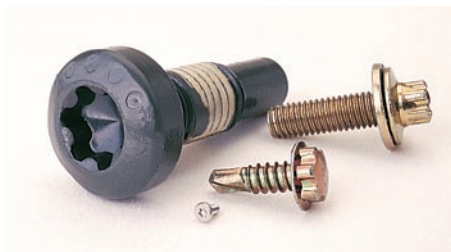


# DESIGN & DRIVE SELECTION GUIDELINES

## INTERNAL TORX PLUS® DRIVE SYSTEM STANDARD DRIVE SIZE SELECTION

Drive Size											
	Pan Head		Flat Head		Socket Head		Socket Button		Truss Head		Fillister
	Inch	Metric	Inch	Metric	Inch	Metric	Inch	Metric	Inch	Metric	Inch
1IP	—	M0.9	—	M0.9 & M1	—	M0.9	—	—	—	—	—
2IP	—	M1	—	M1.2	—	M1	—	—	—	—	—
3IP	—	M1.2	#0	M1.4	—	M1.2	—	—	—	—	—
5IP	#0	M1.4 & M1.6	#1	M1.6 & M1.8	—	M1.4 & M1.6	—	—	—	—	—
6IP	#1	M2	#2	M2	#0	M2	#2	—	#2	—	#1
7IP	#2	—	#3	—	#1	—	#3	—	#3	—	#2
8IP	#3	M2.5	#4	M2.5	#2 & #3	M2.5	#4	M3	#4	—	#3
10IP	#5	M3	#5 & #6	M3	#4 & #5	M3	#6	M3.5	#5 & #6	M3.5	#4 & #5
15IP	#6	M3.5	#8	M3.5	#6	M3.5	#8	M4	#8	M4	#6
20IP	#8	M4	#10	M4	#8	M4	#10	—	#10	M5	#8
25IP	#10	M5	#12	M5	#10	M4.5	—	M5	#12	—	#10
27IP	#12	—	—	—	—	M5	—	M6	1/4	—	#12
30IP	1/4	M6	1/4	M6	1/4	M6	1/4	—	5/16	M6	1/4
40IP	5/16	—	5/16	M8	—	M7	5/16	M8	3/8	M8	5/16
45IP	3/8	M8	3/8 & 7/16	—	5/16	M8	3/8	M10	7/16	—	3/8
50IP	7/16	M10	1/2	M10	3/8	M10	—	—	1/2	M10	7/16
55IP	1/2	M12	9/16 & 5/8	M12	7/16 & 1/2	M12	1/2	M12 & M14	9/16 & 5/8	M12	1/2 & 9/16
60IP	—	—	3/4	—	9/16	M14	5/8	M16	3/4	—	5/8
70IP	—	—	—	—	5/8	M16	—	—	—	—	3/4
80IP	—	—	—	—	3/4	M18	—	—	—	—	—
90IP	—	—	—	—	—	M20	—	—	—	—	—
100IP	—	—	—	—	7/16 & 1	M22 & M24	—	—	—	—	—

Other sizes and head styles not shown here may be available. Please contact your Textron Fastening Systems representative for more information.



The TORX PLUS Drive is available in a variety of sizes and styles to meet your specific needs.

## EXTERNAL TORX PLUS LOW-PROFILE HEAD STANDARD DRIVE SIZE SELECTION



Drive	Inch	Metric	Drive	Inch	Metric
H7EP	#0000	M0.6	14EP	5/16	M8
H4EP	#000	M0.8	16EP	3/8	M10
H3EP	—	M1.0	18EP	7/16	—
H2EP	#00	M1.2	20EP	—	M12
1EP	#0	M1.6	22EP	1/2	—
2EP	#1	M2	24EP	9/16	M14
4EP	#2 & #3	M2.5	26EP	5/8	M16
5EP	#4 & #5	M3	30EP	—	M18
6EP	#6	M3.5	32EP	3/4	M20
7EP	#8	M4	36EP	7/8	M22
8EP	#10	M4.5 & M5	40EP	—	M24
10EP	#12 & 1/4	M6	42EP	1	—
12EP	—	M7			

# IT'S TIME YOU TRIED THE TORX PLUS® DRIVE

The superiority of the TORX PLUS Drive System is well-documented. No matter what the industry, no matter what the application, the TORX PLUS Drive System is proven to keep assembly lines running smoother and more efficiently.



## CONVERT FOR THE ULTIMATE IN COST SAVINGS

The real savings from the TORX PLUS Drive System are on the bottom line. When factors such as the cost of drive tools, line downtime, design flexibility, productivity, scrap/rework per shift, worker fatigue and overall product integrity are considered, the choice to convert becomes clear.

Textron Fastening Systems can assist in your conversion to the TORX PLUS Drive System by providing sample fasteners, drive tools, sales drawings and technical data; conducting engineering seminars; and performing comparative laboratory testing on your application in a simulated production line environment.

## TORX PLUS DRIVE INFORMATION ONLINE

To put the information you need at your fingertips, Textron Fastening Systems maintains a web site focused on the TORX PLUS Drive System. Technical and design data, including head specifications, test results, downloadable literature and CAD drawings are all available at [www.camcar.textron.com/torxplus](http://www.camcar.textron.com/torxplus).

## TORX PLUS DRIVE SOLUTIONS INCREASED TOOL BIT LIFE INCREASES PRODUCTIVITY

APPLICATION: Disk drive for personal computers

ASSEMBLY METHOD: Automated

ASSEMBLY PROBLEM: When using the TORX Drive System, the manufacturer was only able to build 200 disk drives per drive bit.

TORX PLUS DRIVE SOLUTION: TORX PLUS Drive fasteners

CUSTOMER BENEFITS:

- Manufacturer is building 2,000 disk drives per tool bit
- Lower drive tool costs
- Increased productivity due to fewer drive tool changes



**For a free TORX PLUS Drive Solutions packet, including information on the TORX PLUS Drive System, AUTOSERT feature, tooling, gaging or any of our products and services, please contact:**

## TEXTRON Fastening Systems

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**1-800-544-6117 (USA & Canada)**

