

DEFINITION

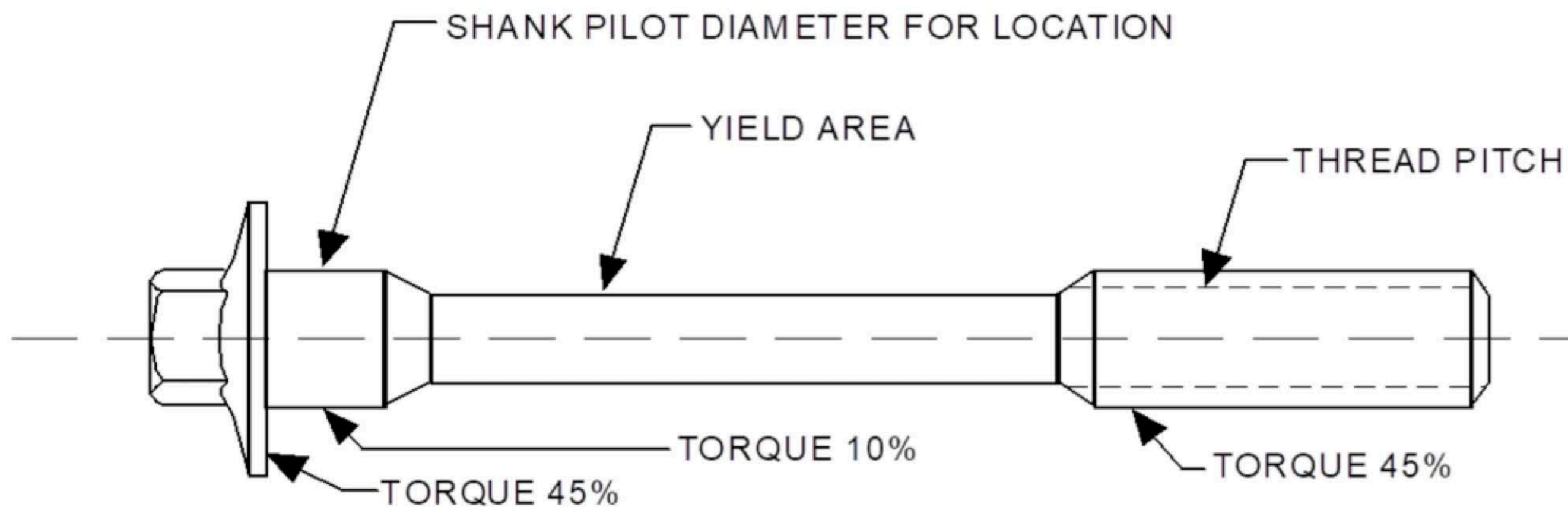
PHASES OF TIGHTENING

- **RUNDOWN:**
 - **THERE IS NO CONTACT BETWEEN THE FASTENER & COMPONENTS BEING CLAMPED**
- **DRAWDOWN:**
 - **THE JOINT IS SEATED & THERE IS CONTACT BETWEEN ALL COMPONENTS BEING CLAMPED**
- **ELASTIC DEFORMATION/CLAMP LOAD BUILD:**
 - **CREATED WHEN TORQUE IS APPLIED & IS THE PRIMARY GOAL WHEN TIGHTENING**
- **PLASTIC DEFORMATION:**
 - **YIELD STRENGTH IS ACHIEVED & THE FASTENER BEINGS TO DEFORM PERMANENTLY**



DEFINITION

TORQUE TO YIELD



A TRUE TORQUE TO YIELD BOLT

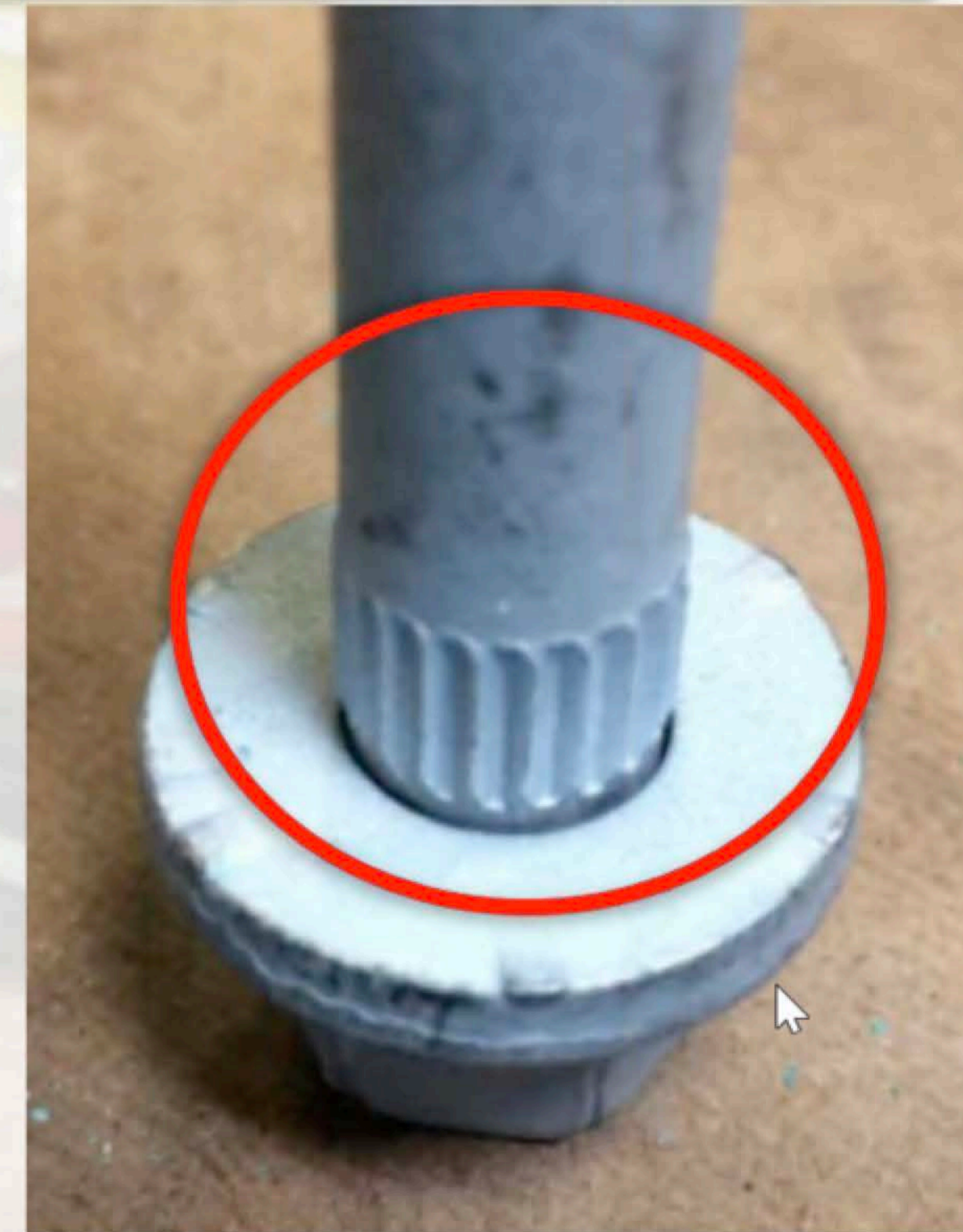
Torque is used to overcome the friction that exist under the head, in the threads, on the shank and to develop the necessary clamp load to hold the joint together.

- **DESIGNED TO BE TORQUED BEYOND THE STATE OF ELASTICITY & THEREFORE UNDERGOES PLASTIC DEFORMATION, CAUSING IT TO BECOME PERMANENTLY ELONGATED**
- **TORQUING TO YIELD POINT RESULTS IN HIGH PRELOADING**
- **COMPARED TO NORMALLY TIGHTEN HARDWARE, TORQUE TO YIELD HARDWARE CAN BE SMALLER & STILL MAINTAIN THE SAME CLAMPING FORCE**

DEFINITION

WHAT IS TORQUE?

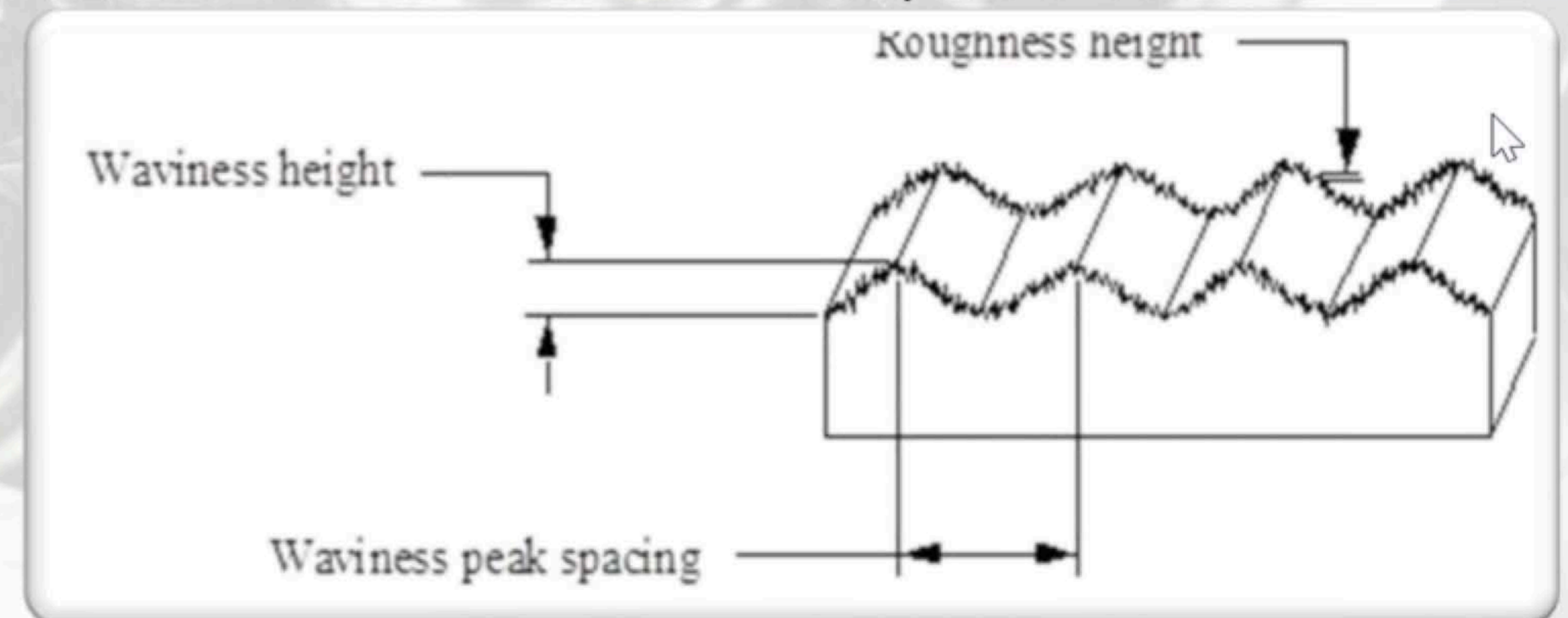
- **A MEASUREMENT OF HOW MUCH FORCE ACTING ON AN OBJECT CAUSES THAT OBJECT TO ROTATE ON AN AXIS**
- **THREADED FASTENERS TIGHTEN UNDER TORSIONAL FORCE CREATING BOLD TENSION & A CLAMPING FORCE**
- **TORQUE IS NOT ENERGY; IT IS A CROSS PRODUCT OF TWO VECTORS:**
 - **1 LBS. FT.= 1 POUND OF FORCE ACTING ON THE END OF A 1 FOOT LEVER**
- **TORQUE IS USED TO OVERCOME THE FRICTION BETWEEN THE FASTENER & INSERT**
 - **ABOUT 50% IS USED TO OVERCOME FRICTION BETWEEN UNDERSIDE OF BOLT HEAD/WASHER & MATING SURFACE**
 - **ABOUT 30% IS USED TO OVERCOME FRICTION IN THE THREADS**
 - **ABOUT 20% OF THE REMAINING TORQUE TO STRETCH THE BOLT & CREATE THE DESIRED CLAMP LOAD**



APPLICATION

- **MAKE SURE ALL THE HEAD BOLTS ARE IN PERFECT CONDITION WITH CLEAN, UNDAMAGED THREADS**
 - **DIRTY/DAMAGED THREADS CAN GIVE FALSE TORQUE READINGS AS WELL AS DECREASE A BOLT'S CLAMPING FORCE BY UP TO 50%**
- **ON AFTERMARKET STUDS/BOLTS, NEVER USE A DIE TO RECUT THREADS. MOST HAVE ROLLED THREADS WHICH ARE STRONGER THAN STANDARD THREADS (USE THREAD CHASER)**
- **RESURFACING CYLINDER HEAD DECREASES ITS OVERALL HEIGHT, BE SURE TO CHECK BOLT LENGTH SO AS NOT TO BOTTOM OUT**
 - **IF BOLT BOTTOMS OUT, IT WILL APPLY LITTLE OR NO CLAMPING FORCE ON THE HEAD & COULD RESULT IN GASKET LEAK**
 - **USE HARDEN STEEL WASHERS UNDER BOLTS TO RAISE THEM UP**

- **MLS GASKETS ARE DESIGNED WITH 2-5 SHEETS OF SPRING OR CARBON STEEL SANDWICHED BETWEEN THE HEAD GASKET'S SEALING MATERIAL**
- **PRECISELY SHAPED BEADS & STOPPERS WORK WITH SPECIFIC STEEL PROPERTIES TO INCREASE CLAMPING FORCE AROUND THE COMBUSTION CHAMBER**
- **THOUGHT RARELY IS GIVEN TO GASKETS, MOST OFTEN DIMENSIONS ARE THE ONLY CONSIDERATION WHEN CHOOSING**
- **HEAD GASKETS SPECIFICALLY HAVE TO CONTAIN MILLIONS OF EXPLOSIONS AND DEAL WITH THE EXPANSION & CONTRACTION OF DISSIMILAR METALS AND RANGE OF TEMPERATURE/CHEMICALS**



APPLICATION

MLS GASKET & CLAMPING FORCE

- **BY NATURE OF THE STOPPER & BORE BEADS (EMBOSSMENTS) & THE SPRING LIKE EFFECT OF THE METAL; LESS TORQUE REQUIRED FROM THE HEAD BOLTS & MORE FORGIVING IF TORQUE IS NOT APPLIED EVENLY**
 - **BY REQUIRING LESS TORQUE TO MAKE THE SAME SEAL, THERE IS LESS CHANCE OF CASTING DISTORTION & CYLINDER WALL DISTORTION**
 - **IF A BOLT IS NOT COMING UP TO NORMAL TORQUE OR IS NOT HOLDING A READING, IT MEANS TROUBLE. EITHER THE BOLT IS STRETCHING OR THE THREADS ARE PULLING OUT OF THE BLOCK. WITH TTY HEAD BOLTS, USE A "TORQUE-TO-ANGLE" INDICATOR GAUGE WITH TORQUE WRENCH TO ACHIEVE PROPER BOLT LOADING... DO NOT GUESS, BE EXACT!**
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