The Barn Raiser

Mid-South Engineering Company

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Who's Your Civil Engineer?

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Today's Civil Engineer does more than just the grading, and erosion and sediment control plans. They take care of rezoning, overall site layout, local ordinance compliance, driveway permits, storm water management, underground utilities, potable water permits, sanitary sewer permits, site traffic patterns, and raw material and finished goods logistics. The Civil Engineer also provides coordination between building plumbing, building foundations, equipment foundations, electrical duct banks, surveyors, vendors, etc. They even provide coordination between other Civil Engineers hired to assist with local ordinances and contractor selection!

This is why more and more clients are hiring the Civil Engineers directly outside of EPC contracts or requesting their presence early in the process. Clients from industrial project managers to architects use their Civil Engineer to help navigate the local, state and federal regulations and codes. The clients get early input on buffering, driveway entrances, railroad spurs, drainage patterns, available site utilities and soil boring locations to assist with early layout and studies.

The Civil Engineer remains your advocate throughout the design process coordinating other disciplines with the overall goal of maintaining the intended traffic flow, drainage pattern and utility connections. This coordination not only saves you time during construction but saves you money.

Ever been through the demolition of buildings, drives, utilities, etc. for an expansion of an existing facility? Want to do that on a Greenfield project? Clients do not budget costs for demolition of new pads, drives and utilities on new sites because it is not expected! Nevertheless, we have seen clients spend money on engineering redesign and demolition of new construction because they self-performed the site development or used a partially developed existing site to save money.

The Civil Engineer provides the first bid and construction drawings for grading, Storm Water Pollution Prevention Plan (SWPPP), storm water collection, potable water distribution, sanitary sewer collection, etc. At the end of the project, the Civil Engineer provides the record drawings of the underground utilities, foundations, road, etc. for final occupancy permits and to be used as reference material throughout the life of the facility.

Today's Civil Engineer works with the client to coordinate the overall site layout, traffic, and maze of utilities to free the clients to concentrate on the process, equipment and buildings. Along with the project and construction managers, the Civil Engineer is your advocate throughout the design, permitting and construction of your project.

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STRUCTURAL BOLTS
Why you shouldn't substitute

On the surface it appears that the mechanical requirements in an ASTM A325 and an SAE J429 Grade 5 bolt, as well as an ASTM A490 and the SAE J429 Grade 8 bolt are identical to each other. So can you substitute the SAE J-bolt for the ASTM-A bolt? The answer is a resounding, "NO".

There are two standard structural bolts in the United States, ASTM A325 and ASTM A490. These bolts are produced with heavy hex heads for a purpose, and that is to provide a wide bearing surface to distribute the load the bolt is intended to handle. The heads of the Grade 5 and Grade 8 SAE J-bolts are smaller than their ASTM A-bolts being compared to one another. Each type of structural bolt is also designed with a different length of shank (the non-threaded section) for the proper application in the use of each type of bolt. The shank portion of the bolt is stronger, due predominantly to its cross sectional diameter, than the threaded portion for resisting shear forces. The thread length will also affect the shear strength of the bolt. When an ASTM A-Bolt has been called out, it is done so to allow the shank to withstand the shear forces rather than the treaded portion of a bolt.

Structural bolts are intended and designed to be used with heavy hex nuts for their structural connections. The nuts are to conform to ASTM A563 or ASTM A194. The chart below, can be referenced for the correct pairing of bolts with the proper nuts. It is also important to use circular or beveled washers, of the proper structural make-up, with the bolt and nut pair.

Mechanical Properties of ASTM A325 and A490 Structural Bolts

Specification	Material	Grade Identification Marking	Size Range (in.)	Min. Proof Strength (psi)	Min. Tensile Strength (psi)	Core Hardness Rockwell Min.	Core Hardness Rockwell Max.	ASTM A563 Compatible Heavy Hex Nut
ASTM A325 Type 1	Medium carbon steel: quenched & tempered	A325	1/4 - 1 1 1/8 - 1 1/2	85,000 74,000	120,000 105,000	C25 C19	C34 C30	Grade C (plain) Grade DH (plain or galvanized)
ASTM A325 Type 3	Weathering steel: quenched & tempered	A325	1/4 - 1 1 1/8 - 1 1/2	85,000 74,000	120,000 105,000	C25 C19	C34 C30	Grade C3 Grade DH3
ASTM A490 Type 1	Medium carbon alloy steel: quenched & tempered	A490	1/4 - 1 1/2	120,000	150,000 (min) 173,000 (max)	C33	C39	Grade DH (plain)
ASTM A490 Type 1	Weathering steel: quenched & tempered	A490	1/4 - 1 1/2	120,000	150000 (min) 173,000 (max)	C33	C39	Grade DH3

ASTM A563 considers the ASTM A194/A194M heavy hex nuts as acceptable equivalents for the DH heavy hex nut.

Other important aspects of a structural bolt include: corrosion resistance and tensioning (snug-tightened, pre-tensioned and slip critical connections).

The ASTM A490 bolt shouldn't be galvanized or electroplated to resist corrosive environments. The hot dip galvanizing temperature of the molten zinc bath will exceed the fastener's tempering temperature causing the bolt to anneal while being coated. In addition, both hot dip galvanizing and electroplating an A490 bolt has the potential for hydrogen embrittlement. If an A490 bolt requires a protective coating then the ASTM F1136 Grade 3 standard is the only approved method. The ASTM A325 type 1, medium carbon, bolt can be galvanized and the type 3 A325 consists of a weathering steel which offers atmospheric corrosion resistance similar to that of ASTM A242 or A588 steels. Type 3 ASTM A490 bolts offer the same resistance to atmospheric corrosion.

There are four methods recognized by the AISC in the installation process of structural bolts and nuts; it is important that the crew installing the bolts knows which method is needed and how to correctly tension the bolts. The four methods to be reviewed by the installation crew are:

1. Turn-of-nut method
2. Alternative design bolt method
3. Direct tension indicating method
4. Calibrated wrench method

While we've not tried to supply you with every detail on structural bolts, we hopefully have given enough guidance to implement structural projects using the correct components and not making substitutions in bolts without understanding the consequences. There is a saying that has been proven time and time again: "*The Devil is in the Details.*" If we don't pay attention to small "nuts and bolts" details of a project, then we will be faced with the Devil to pay for any short comings. It also emphasizes that attention be given to the even bigger parts of a structural job with the same detailed mind set.

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