BOLTING RESOURCES GUIDE

Safe Bolting Training Guide

Industrial Users of Industrial Fasteners

Information-How to Use Industrial Fasteners

Maintenance

Procedures for Tightening Fasteners

Charts and Forms

- Fastener Identification
- Bolt Patterns
- Torque Charts
- Bolt Load

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Safe Bolting Principles, Procedures, and Practices Training Guide

Introduction: Bolting is a critical aspect of various industries, including construction, manufacturing, and maintenance. Proper bolting procedures are essential for ensuring the safety and integrity of structures and equipment. This training guide aims to educate individuals on safe bolting principles, procedures, and practices to minimize the risk of accidents, equipment failures, and injuries. By following these guidelines, you can contribute to a safer and more efficient workplace.

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NOTE: What could go wrong and the repercussions…

Training Methodology:

1. **Classroom Sessions:** Interactive lectures and presentations covering theoretical aspects of bolting.
2. **Hands-on Training:** Practical sessions using bolting tools and equipment.
3. **Case Studies:** Reviewing real-world examples to understand the consequences of improper bolting.
4. **Group Discussions:** Encourage participants to share experiences and knowledge.
5. **Assessments:** Periodic quizzes and tests to evaluate understanding.
6. **Practical Examinations:** Testing participants' ability to carry out bolting procedures safely and correctly.

Training Duration:

The training program may vary in length depending on the participants' prior knowledge and the specific industry requirements. A typical program may span 1 to 5 days.

Evaluation and Certification:

Participants will be evaluated through written tests and practical examinations. Those who successfully complete the training will receive a certificate of competency in safe bolting practices.

Continuous Improvement:

Encourage participants to stay updated with the latest industry standards and practices. Provide resources for ongoing learning and development.

Note: Always adhere to the specific safety guidelines and regulations applicable to your industry and location. This training guide serves as a general framework and should be adapted to suit your organization's needs and requirements.

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1. Understanding Bolting

a. **Importance of Bolting**

- **Structural Integrity**: Explain how bolting is a critical component of maintaining the structural integrity of various applications, from bridges to machinery.
- **Safety**: Emphasize that properly executed bolting is essential to prevent accidents and injuries caused by equipment failure.

b. **Types of Bolts and Fasteners**

- **Bolt Types**: Detail various bolt types, including hex bolts, stud bolts, and carriage bolts, and

discuss their specific applications.
- **Nuts and Washers**: Explain the role of nuts and washers in bolting systems and their variations.

c. **Common Bolting Applications**
- **Construction**: Highlight bolting applications in construction, such as connecting beams and columns in buildings.
- **Manufacturing**: Discuss bolting's role in assembling machinery and equipment on factory floors.
- **Maintenance**: Explain how bolting is crucial in maintenance activities, including replacing worn-out parts and repairing infrastructure.

2. Bolting Materials and Tools
a. **Types of Bolting Materials (bolts, nuts, washers)**
- **Material Properties**: Explain the properties of commonly used bolting materials, such as steel, stainless steel, and non-ferrous metals.
- **Coatings**: Discuss the importance of coatings, such as zinc plating, for bolting materials in corrosive environments.

b. **Tools and Equipment**
- **Wrench Types**: Describe various types of wrenches, including open-end, box-end, and adjustable wrenches.
- **Torque Wrenches**: Explain the function and types of torque wrenches, such as click-type and beam-type wrenches.
- **Tensioning Devices**: Discuss the use of hydraulic and pneumatic tensioning devices for achieving precise tension in bolts.

c. **Inspection and Maintenance of Bolting Tools**
- **Calibration**: Explain the need for regular calibration of bolting tools to ensure accurate torque or tension readings.
- **Maintenance Practices**: Detail maintenance practices for bolting tools, such as cleaning, lubrication, and replacement of worn parts.

3. Safety Precautions
a. **Personal Protective Equipment (PPE)**
- **Head to Toe Protection**: Discuss the different types of PPE required for bolting tasks, including hard hats, safety glasses, gloves, and steel-toed boots.

- **Respiratory Protection**: Mention situations where respiratory protection may be necessary, such as when working with hazardous materials.

b. **Hazard Identification**
- **Common Hazards**: Identify common bolting-related hazards, such as falling objects, pinch points, and exposure to chemicals.
- **Risk Assessment**: Explain how to conduct a risk assessment before starting bolting operations to identify and mitigate potential hazards.

c. **Lockout/Tagout Procedures**
- **Lockout/Tagout Definitions**: Define lockout/tagout (LOTO) and its purpose in ensuring equipment safety during bolting activities.
- **Procedure Steps**: Provide a step-by-step guide on how to perform LOTO, including isolating energy sources and affixing lockout tags.

d. **Fire Safety**
- **Fire Prevention**: Explain measures to prevent fires during bolting operations, such as avoiding sparks and keeping flammable materials away.
- **Fire Response**: Describe the actions to take in case of a fire emergency, including the use of fire extinguishers and evacuation procedures.

4. Torque and Tension

a. **Torque vs. Tension**
- **Torque Definition**: Define torque as a rotational force applied to a bolt.
- **Tension Definition**: Define tension as the axial force that stretches a bolt.

b. **Proper Torque Techniques**
- **Torque Application**: Explain the importance of applying torque evenly and gradually to prevent bolt damage or distortion.
- **Torque Specifications**: Discuss how torque specifications are determined and provide examples for different bolt sizes and materials.

c. **Tensioning Methods**
- **Hydraulic Tensioning**: Describe the use of hydraulic tensioning devices to achieve precise tension in bolts.
- **Manual Tensioning**: Explain manual tensioning techniques and considerations.

d. **Using Torque Wrenches and Tensioning Devices**

- **Torque Wrench Operation**: Provide a step-by-step guide on how to use torque wrenches correctly, including setting torque values and interpreting readings.
- **Tensioning Device Operation**: Explain the operation of tensioning devices, including the importance of monitoring tension levels during use.

5. Bolting Procedures

a. **Bolting Sequence**

- **Sequential Tightening**: Emphasize the significance of following a specific sequence when tightening multiple bolts to ensure even load distribution.
- **Sequential Unfastening**: Discuss the reverse sequence for unfastening bolts.

b. **Pre-Installation Checks**

- **Component Inspection**: Explain the importance of inspecting bolts, nuts, washers, and gaskets for defects or damage before installation.
- **Surface Preparation**: Detail the steps for cleaning and preparing the bolted surfaces for assembly.

c. **Installation Steps**

- **Bolt Insertion**: Describe how to properly insert bolts into holes, ensuring they are correctly aligned and seated.
- **Tightening Procedures**: Provide a step-by-step guide on how to tighten bolts using torque wrenches or tensioning devices.

d. **Post-Installation Inspections**

- **Visual Inspection**: Explain how to visually inspect the bolted joint for signs of proper seating, alignment, and potential issues.
- **Torque Verification**: Discuss the importance of verifying torque values to ensure they meet specifications.

e. **Tightening Strategies (Torque vs. Angle)**

- **Torque Control**: Explain the concept of torque control and how to achieve the required torque values.
- **Angle Control**: Describe the use of angle control in tightening bolts, especially in critical applications.

f. **Torque and Tension Control**

- **Monitoring**: Emphasize the need for continuous monitoring during the tightening process to

detect any anomalies or issues.
- **Adjustments**: Explain how to make necessary adjustments to achieve the desired torque or tension values.

6. Joint Integrity

a. Gasket Selection and Installation

- **Gasket Types**: Explain various gasket types, such as flat gaskets, spiral wound gaskets, and ring gaskets, and their appropriate applications.
- **Material Compatibility**: Emphasize the importance of choosing gasket materials compatible with the fluid or gas being sealed and the temperature and pressure conditions.
- **Installation Procedures**: Provide step-by-step instructions for installing gaskets, including proper alignment and tightening procedures.

b. Proper Flange Alignment

- **Alignment Techniques**: Describe techniques for aligning flanges accurately, such as the use of alignment pins or jacks.
- **Consequences of Misalignment**: Discuss the potential consequences of misaligned flanges, including leaks, stress concentration, and increased maintenance costs.
- **Tools and Equipment**: Introduce tools and equipment that aid in flange alignment, such as laser alignment systems.

c. Bolting Patterns and Sequence

- **Flange Patterns**: Explain different flange patterns and the appropriate bolting sequence for each, considering factors like gasket type and material.
- **Uniform Stress Distribution**: Stress the importance of following bolting patterns to achieve uniform stress distribution across the gasket.
- **Preventing Flange Distortion**: Discuss how bolting sequence can prevent flange distortion and warping.

d. Joint Tightness Testing

- **Hydrostatic Testing**: Describe the process of using water or another liquid to pressurize the system and check for leaks.
- **Pneumatic Testing**: Explain the use of compressed air or gas for testing joint tightness.
- **Interpreting Test Results**: Provide guidelines for interpreting test results, including leak detection and pressure drop considerations.

7. Quality Control

a. Documentation

- **Purpose of Documentation**: Explain why accurate documentation of bolting procedures, torque values, and materials used is crucial for quality control.
- **Documenting Changes**: Stress the importance of documenting any changes or adjustments made during the bolting process for traceability.

b. Record-Keeping

- **Retention Periods**: Detail how long records should be retained according to industry standards and regulations.
- **Digital Records**: Discuss the benefits of digital record-keeping systems for easy retrieval and analysis.

c. Non-Destructive Testing (NDT)

- **NDT Methods**: Elaborate on common NDT methods like ultrasonic testing, radiographic testing, and dye penetrant testing.
- **Inspection Procedures**: Describe how these methods are applied to assess the integrity of bolted joints.
- **Interpreting NDT Results**: Discuss how to interpret NDT results and determine if any further action is required.

d. Bolted Joint Audits

- **Audit Planning**: Explain how to plan and conduct comprehensive bolted joint audits, including choosing the right personnel.
- **Audit Checklist**: Provide a sample checklist of items to inspect during a bolted joint audit, covering aspects like torque values, alignment, and gasket condition.
- **Reporting and Recommendations**: Discuss how to compile audit findings, make recommendations for improvements, and implement corrective actions.

8. Troubleshooting and Maintenance

a. Identifying Bolting Issues

- **Common Issues**: List and describe common bolting issues, such as leaks, loosening, and corrosion.
- **Visual Inspection**: Explain how visual inspection can often reveal early signs of bolting problems.

b. Remedial Actions

- **Emergency Procedures**: Provide guidance on what to do in emergency situations, such as a

sudden leak or bolt failure.
- **Repairs**: Explain how to conduct repairs, including the replacement of damaged or corroded bolts and gaskets.

c. **Preventive Maintenance**
- **Maintenance Schedule**: Recommend establishing a preventive maintenance schedule for bolted joints.
- **Inspection Guidelines**: Detail what to look for during routine inspections and maintenance checks.
- **Bolt Replacement**: Discuss when and how to replace bolts to ensure the continued integrity of the joint.

d. **Re-tightening and Inspection**
- **Frequency of Re-tightening**: Explain when re-tightening may be necessary and how often it should be performed.
- **Procedures**: Provide step-by-step procedures for re-tightening bolts, including the use of torque wrenches or tensioning devices.
- **Inspection After Re-tightening**: Stress the importance of inspecting the joint after re-tightening to confirm proper seating and tightness.

9. Case Studies and Examples

a. **Real-world bolting scenarios**
- **Construction Industry**: Present examples of successful bolting projects in construction, such as structural steel connections or bridge construction.
- **Manufacturing**: Highlight instances of effective bolting in manufacturing settings, such as assembling machinery.
- **Oil and Gas**: Showcase successful bolting applications in the oil and gas industry, like pipeline construction.

b. **Lessons learned from failures**
- **Case Analysis**: Conduct an in-depth analysis of bolting failures, discussing root causes and the impact on safety and operations.
- **Preventive Measures**: Emphasize the lessons learned from failures and how they can inform better bolting practices.

c. **Successful bolting projects**
- **Key Success Factors**: Discuss the factors that contributed to the success of specific bolting projects, such as meticulous planning, skilled labor, and quality materials.

- **Efficiency Gains**: Explain how proper bolting practices can lead to increased efficiency, reduced downtime, and cost savings.

10. Certification and Training

a. **Bolting Certification Programs**

- **Certification Bodies**: List reputable certification bodies and organizations offering bolting certification programs, such as ASME or API.
- **Requirements**: Explain the prerequisites, training requirements, and examinations associated with certification programs.

b. **Continuous Learning Opportunities**

- **Professional Development**: Encourage participants to pursue continuous learning through workshops, seminars, and online courses.
- **Industry Conferences**: Provide information on industry conferences related to bolting and maintenance.

c. **Training Resources**

- **Recommended Textbooks**: Suggest authoritative textbooks and publications covering bolting principles and practices.
- **Online Resources**: List websites, forums, and online communities where participants can access additional bolting resources.

11. Conclusion

a. **Recap of Key Takeaways**

- **Safety Emphasis**: Reiterate the importance of safety as the primary concern in bolting operations.
- **Quality and Reliability**: Stress the significance of quality bolting for equipment reliability and structural integrity.

b. **Importance of Safe Bolting Practices**

- **Commitment to Safety Culture**: Encourage participants to embrace a culture of safety in their workplaces and be advocates for safe bolting practices.
- **Continuous Improvement**: Highlight that bolting is a continuous learning process, and ongoing training is essential for maintaining and improving skills.

c. **Commitment to Safety**

- **Personal Responsibility**: Encourage participants to take personal responsibility for following

established bolting procedures, conducting thorough inspections, and reporting any safety concerns.
- **Team Collaboration**: Stress the importance of teamwork in achieving safe and successful bolting outcomes, as it often involves coordination among multiple workers.

From a safety aspect, by following the above information, what possibly could go wrong?

While following the above information on safe bolting principles, procedures, and practices significantly reduces the risk of accidents and enhances safety, it's essential to be aware of potential challenges or issues that can still arise. Here are some safety-related considerations:

1. **Inadequate Training:** If individuals conducting bolting operations are not adequately trained, they may not fully understand the procedures and safety precautions, leading to errors and accidents.
2. **Tool Calibration Errors**: Torque wrenches and tensioning devices must be accurately calibrated. If calibration is not performed correctly or on schedule, bolts may not be tightened to the required specifications, risking joint failure.
3. **Poor Maintenance**: Neglecting the maintenance of bolting tools and equipment can lead to malfunctions or inaccuracies, jeopardizing the quality and safety of bolted joints.
4. **Misapplication of Torque/Tension**: Using the wrong method (torque or tension) for a specific application can result in under-tightened or over-tightened bolts, which can compromise joint integrity.
5. **Lack of Quality Control**: Inadequate documentation, record-keeping, and quality control measures may lead to uncertainty about the condition of bolted joints and hinder the ability to identify potential issues.
6. **Inadequate Gasket Selection**: Choosing the wrong type or size of gasket or failing to properly install gaskets can result in leaks and joint failures.
7. **Improper Flange Alignment**: Misaligned flanges can cause excessive stress on bolts, leading to joint failure. Proper alignment is crucial to prevent this issue.
8. **Bolted Joint Audits Neglected**: Failure to conduct regular bolted joint audits can result in undetected issues, potentially leading to safety hazards or equipment failures.
9. **Failure to Identify Hazards**: If hazard identification is not thorough, workers may inadvertently encounter dangerous situations, such as pinch points or falling objects.

10. **Inadequate Lockout/Tagout**: If lockout/tagout procedures are not followed rigorously, equipment may inadvertently start during bolting operations, posing a severe safety risk.
11. **Fire Hazards**: Failure to follow fire safety procedures, such as ensuring a spark-free environment when working near flammable materials, can lead to fires and injuries.
12. **Emergency Response**: Inadequate preparation for emergency situations, such as leaks or equipment failures during bolting, can result in delayed or ineffective responses.
13. **Improper Torque/Tension Control**: Failing to monitor and control torque or tension levels during the tightening process may result in bolts being under- or over-tightened, compromising joint integrity.

To mitigate these potential safety risks, it's crucial to:

- Ensure that all personnel involved in bolting operations receive proper training and certification.
- Implement a robust quality control program, including thorough documentation and record-keeping.
- Regularly inspect, calibrate, and maintain bolting tools and equipment.
- Follow industry-specific safety regulations and standards.
- Promote a safety culture within the organization, emphasizing the importance of safety in bolting activities.
- Encourage open communication and reporting of safety concerns or incidents.

By addressing these potential challenges and maintaining a strong commitment to safety, organizations can significantly reduce the likelihood of accidents and injuries associated with bolting operations.

What could be the repercussions if the safety procedures are not followed?

Failure to follow safety procedures in bolting operations can lead to a wide range of repercussions, including:

1. **Injuries and Fatalities**: The most significant consequence is the potential for accidents resulting in injuries or even fatalities to personnel involved in the bolting

process. These injuries can range from minor cuts and bruises to severe crushing injuries, burns, or even fatalities.

2. **Equipment Damage**: Improper bolting procedures can cause equipment and machinery damage, leading to costly repairs and downtime. Equipment failure can also result in secondary accidents or incidents.
3. **Environmental Damage**: Leaks or spills caused by improperly sealed bolted joints can lead to environmental contamination, posing legal and financial liabilities. This damage may include soil or water pollution and harm to wildlife.
4. **Financial Losses**: Safety lapses can result in direct financial losses due to equipment repair or replacement, medical expenses, legal costs, and potential fines or penalties for non-compliance with safety regulations.
5. **Reputation Damage**: Incidents resulting from safety violations can harm a company's reputation. Negative publicity and public perception can affect customer trust, investor confidence, and business relationships.
6. **Worker Morale and Turnover**: Unsafe working conditions can negatively impact employee morale, leading to reduced productivity and increased turnover. Workers may seek employment elsewhere due to concerns about their safety.
7. **Legal Consequences**: Non-compliance with safety regulations can result in legal action, including fines, penalties, and even criminal charges against the organization, its managers, or employees responsible for safety lapses.
8. **Increased Insurance Costs**: Frequent accidents and safety violations can lead to higher insurance premiums, increasing operational costs for the organization.
9. **Loss of Business Opportunities**: Poor safety records can deter potential clients, partners, or investors from engaging with the organization, limiting growth and business opportunities.
10. **Regulatory Scrutiny**: Incidents or safety violations can trigger regulatory investigations, audits, and increased scrutiny from governmental agencies, potentially resulting in stricter oversight and compliance requirements.
11. **Loss of Contracts**: Some clients or contractors may require proof of a strong safety record as a condition for awarding contracts. Failure to meet these requirements can result in the loss of lucrative projects.
12. **Worker's Compensation Claims**: Injured employees may file worker's compensation claims, leading to additional administrative and financial burdens on the organization.
13. **Litigation and Lawsuits**: Victims of accidents or incidents may file civil lawsuits seeking compensation for injuries or damages, leading to legal proceedings and potential financial settlements.

To avoid these repercussions, organizations must prioritize safety in bolting operations by providing proper training, ensuring adherence to safety procedures, conducting regular safety audits, and maintaining a culture of safety consciousness among employees. Proper safety measures not only protect individuals but also safeguard an organization's assets, reputation, and long-term viability.

CHEMICAL PLANT FASTENERS

The composition of equipment necessary to run a chemical plant can vary widely depending on the specific processes, products, and scale of the plant. Chemical plants can be involved in various operations, such as synthesis, separation, purification, and transformation of raw materials into desired chemical products. Here is a general overview of some common types of equipment you might find in a chemical plant:

1. **Reactor Systems:** Reactors are vessels where chemical reactions take place. Different types of reactors are used depending on the reaction conditions and the products being synthesized. Examples include batch reactors, continuous stirred-tank reactors (CSTRs), and fixed-bed reactors.
2. **Distillation Columns:** Distillation is a common separation process used to separate components of a mixture based on their boiling points. Distillation columns can have various configurations, such as fractional distillation columns or packed distillation columns.
3. **Heat Exchangers:** Heat exchangers are used to transfer heat between process streams. They help maintain the desired reaction or separation temperatures and improve energy efficiency.
4. **Pumps and Compressors:** Pumps are used to move liquids through the process, while compressors handle gases. They are crucial for maintaining the flow of materials throughout the plant.
5. **Separation Equipment:** Apart from distillation, chemical plants might use other separation techniques like filtration, crystallization, centrifugation, and chromatography, depending on the nature of the products and raw materials.
6. **Mixers and Agitators:** Mixing equipment ensures uniform blending of reactants and other process materials, which is essential for many chemical reactions.
7. **Reactant and Product Storage Tanks:** Chemical plants require tanks for storing raw materials, intermediates, and final products. These tanks can vary in size and material depending on the chemicals being stored.

8. **Instrumentation and Control Systems:** These systems monitor and control various parameters such as temperature, pressure, flow rates, and more to ensure the processes are running smoothly and safely.
9. **Safety Equipment:** Chemical plants require safety measures like emergency shutdown systems, fire suppression equipment, ventilation systems, and personal protective equipment (PPE) to ensure the safety of personnel and prevent accidents.
10. **Utilities and Infrastructure:** Utilities like electricity, water supply, steam, and cooling systems are critical for the operation of a chemical plant.
11. **Analytical Instruments:** Analytical instruments such as spectrometers, chromatographs, and titrators are used to monitor the quality of products and ensure they meet specifications.
12. **Environmental Control Equipment:** To adhere to environmental regulations, chemical plants might incorporate equipment for waste treatment, emissions control, and pollution prevention.

It's important to note that the specific equipment required will depend on the type of chemical processes being carried out in the plant. Engineering and design considerations, as well as safety regulations, will also influence the selection of equipment. Each chemical plant is unique, and the equipment composition will be tailored to the plant's specific needs and production goals.

From the overview of the equipment commonly found in a chemical plant, what type and size of fasteners are needed for the equipment?

The type and size of fasteners needed for equipment in a chemical plant can vary based on factors such as the equipment's function, size, material, and the environment in which it will be used. Fasteners are used to securely join different components of equipment together. Here are some common types of fasteners and considerations for their selection:

1. **Bolts and Nuts:** Bolts and nuts are widely used fasteners in industrial settings. Stainless steel bolts and nuts are often preferred in chemical plants due to their corrosion resistance. The size and strength of the bolts will depend on the load and stresses the equipment will experience.
2. **Screws:** Screws are used for securing components that do not require heavy-duty fastening. Stainless steel screws are suitable for environments where corrosion is a concern.
3. **Washers:** Washers are used to distribute the load and prevent damage to the surfaces being fastened. They can be used in combination with bolts, nuts, and screws to improve fastening integrity.
4. **Anchors:** Anchors are used to attach equipment to concrete or other solid surfaces. They provide stability and prevent movement.
5. **Clamps:** Clamps are used to hold together pipes, tubes, or other cylindrical components. They can be adjustable and are commonly used in piping systems.
6. **Threaded Rods:** Threaded rods are used for applications where a longer fastening option is needed. They can be cut to the desired length and used with nuts at both ends.
7. **Rivets:** Rivets are permanent fasteners that are often used in sheet metal applications. They are particularly useful in joining materials that cannot be easily threaded or welded.
8. **Adhesive Fasteners:** Adhesive fasteners, such as industrial adhesives and sealants, can be used in conjunction with traditional fasteners to provide additional sealing, bonding, and vibration resistance.

When selecting fasteners for a chemical plant, consider the following factors:

- **Corrosion Resistance:** Since chemical plants often deal with corrosive materials, corrosion-resistant materials like stainless steel, titanium, or non-metallic fasteners should be considered.
- **Temperature and Pressure:** Choose fasteners that can withstand the temperature and pressure conditions of the equipment's operating environment.
- **Material Compatibility:** Ensure that the fastener material is compatible with the materials being fastened and will not cause unwanted reactions or contamination.
- **Load and Stress:** Determine the load and stress the fasteners will be subjected to and select fasteners with appropriate strength ratings.
- **Environmental Conditions:** Consider factors such as exposure to chemicals, moisture, and potentially hazardous conditions when choosing fasteners.
- **Ease of Maintenance:** Choose fasteners that can be easily inspected, maintained, and replaced if necessary.
- **Regulatory Compliance:** Ensure that the chosen fasteners meet any industry-specific standards and regulations.

The specific type and size of fasteners will vary based on the equipment's design and requirements. It's recommended to consult with engineers, designers, and fastener suppliers to determine the most suitable fasteners for each piece of equipment in the chemical plant.

What pressures are found in a chemical plant and what fasteners are necessary to secure the equipment used?

Pressures in a chemical plant can vary widely depending on the specific processes and equipment being used. Chemical processes may involve both low-pressure and high-pressure conditions. Here are some examples of pressure ranges you might encounter in different parts of a chemical plant:

1. **Low Pressure:** This category includes pressures up to around 150 psi (pounds per square inch). Many general industrial processes, such as mixing and blending, can fall within this range.
2. **Medium Pressure:** Pressures in the range of 150 psi to 1,000 psi fall into the medium-pressure category. Some chemical reactions and separations occur under these conditions.
3. **High Pressure:** High-pressure operations involve pressures above 1,000 psi, and they can extend to several thousand psi or more. Examples include certain chemical syntheses, catalytic reactions, and some distillation processes.
4. **Ultra-High Pressure:** In specialized applications, such as hydrocarbon cracking or polymerization, pressures can reach tens of thousands of psi.

The selection of fasteners to secure equipment in a chemical plant depends on various factors, including the pressure, temperature, material compatibility, and load-bearing requirements. For equipment exposed to different pressure ranges, here are some considerations for selecting fasteners:

1. **Low to Medium Pressure:**
    - **Bolts and Nuts:** For low to medium pressure applications, standard stainless steel bolts and nuts are often suitable. Ensure that the material is compatible with the process fluids and environment.
2. **Medium to High Pressure:**
    - **High-Strength Bolts:** As pressure increases, fasteners with higher tensile strength might be necessary to withstand the increased load. Alloy steel bolts or specialty fasteners designed for high-pressure applications can be considered.
    - **Flanged Connections:** Flanges are commonly used in piping systems for high-pressure applications. They require bolts, nuts, and gaskets to create a secure and leak-tight connection.
3. **High Pressure and Ultra-High Pressure:**
    - **High-Performance Fasteners:** For extreme pressure conditions, specialized fasteners made from high-strength alloys or materials designed for high-pressure applications might be required.
    - **Precision Machining:** Components subject to ultra-high pressures may require precision machining to ensure proper alignment and integrity of the fastening points.
4. **Sealing Components:**
    - **Gaskets:** Gaskets are crucial for creating a leak-tight seal in high-pressure equipment. The choice of gasket material should consider factors such as temperature, pressure, and chemical compatibility.

When selecting fasteners for high-pressure equipment, it's important to consider factors beyond just pressure, such as temperature, vibration, and potential chemical interactions. Consulting with engineers, equipment manufacturers, and fastener suppliers is crucial to ensure the chosen fasteners are suitable for the specific conditions and requirements of the chemical plant. Additionally, adherence to industry standards and regulations related to pressure vessels and equipment should be followed.

What safety considerations must be in place in a chemical plant involving the fasteners used?

Safety considerations in a chemical plant involving the fasteners used are critical to ensure the overall safety, reliability, and integrity of the plant's operations. Given the potentially hazardous nature of chemicals and the processes in a chemical plant, here are some key safety considerations that must be in place when selecting and using fasteners:

1. **Chemical Compatibility:** Ensure that the chosen fasteners are compatible with the specific chemicals present in the plant. Different chemicals can react with certain metals, leading to corrosion or weakening of the fasteners.
2. **Corrosion Resistance:** Fasteners should be selected based on their resistance to corrosion caused by the chemicals and environmental conditions in the plant. Stainless steel, alloyed steel, or non-metallic fasteners may be suitable choices.

3. **Temperature and Pressure:** Fasteners must be able to withstand the temperature and pressure conditions of the chemical processes. High-pressure and high-temperature applications might require specialized fasteners.
4. **Material Selection:** Choose fasteners made from materials that are chemically inert to the substances they will encounter. Avoid materials that could introduce contaminants or react with chemicals.
5. **Sealing and Gasketing:** Use appropriate sealing components such as gaskets and seals to prevent leaks and ensure a proper, chemical-resistant seal between fastened components.
6. **Proper Torque and Tightening:** Follow manufacturer guidelines and industry standards for proper torque values and tightening procedures to prevent fastener failure or leakage.
7. **Vibration and Dynamic Loads:** Chemical processes can involve fluid flow and mechanical movement. Fasteners should be selected and installed to withstand vibration and dynamic loads without coming loose.
8. **Leak Prevention:** Properly sealed fasteners are crucial to prevent leaks, especially in systems carrying hazardous or toxic chemicals.
9. **Accessibility and Maintenance:** Ensure that fasteners are accessible for inspection, maintenance, and replacement. Consider using designs that allow for easy access without compromising safety.
10. **Locking Mechanisms:** Use fasteners with locking mechanisms, such as self-locking nuts or washers, to prevent unintended loosening due to vibration or dynamic loads.

11. **Personnel Safety:** During installation, maintenance, or repair activities, prioritize personnel safety by providing training, appropriate personal protective equipment (PPE), and safe access to tools and equipment.
12. **Emergency Procedures:** Have well-defined emergency procedures in place for fastener failure or leaks, including shutdown protocols and containment strategies.
13. **Risk Assessment:** Conduct a thorough risk assessment to identify critical points where fastener failure could lead to safety hazards. Prioritize these points for rigorous inspection and maintenance.
14. **Documentation and Traceability:** Maintain records of fastener specifications, locations, and installation dates. This documentation aids in tracking maintenance needs and can assist with troubleshooting.
15. **Supplier Quality:** Source fasteners from reputable suppliers that provide quality-tested products meeting relevant industry standards.
16. **Regulatory Compliance:** Ensure that the selected fasteners comply with relevant safety and environmental regulations.

By addressing these safety considerations, chemical plants can help ensure that the fasteners used contribute to the overall safety and reliability of their operations, reducing the risk of equipment failure, chemical leaks, and potential hazards.

What procedures should be used in doing maintenance in a chemical plant?

Maintenance in a chemical plant is a crucial aspect of ensuring safe, efficient, and reliable operations. Proper maintenance procedures help prevent equipment failures, minimize downtime, and ensure compliance with safety and environmental regulations. Here are some key procedures to consider when conducting maintenance in a chemical plant:

1. **Planning and Scheduling:**
    - Develop a maintenance plan that outlines the scope, frequency, and priority of maintenance tasks.
    - Schedule maintenance activities during planned shutdowns or times of low production demand to minimize disruptions.
2. **Risk Assessment:**
    - Conduct a thorough risk assessment before performing maintenance to identify potential hazards and develop mitigation strategies.
3. **Isolation and Lockout/Tagout:**
    - Isolate equipment from energy sources to prevent unintended startup during maintenance.
    - Implement lockout/tagout procedures to secure equipment and prevent accidental activation.
4. **Training and Qualification:**
    - Ensure maintenance personnel are properly trained, qualified, and familiar with safety procedures.
    - Provide training on handling hazardous materials and working in potentially dangerous environments.
5. **Permitting and Documentation:**

- Obtain any necessary permits for maintenance tasks that involve hazardous materials, confined spaces, or other potentially risky conditions.
- Document maintenance activities, including procedures followed, materials used, and any unexpected findings.

6. **Personal Protective Equipment (PPE):**
    - Ensure that maintenance personnel wear appropriate PPE based on the tasks being performed and the potential hazards involved.
7. **Chemical Handling:**
    - Follow proper procedures for handling, storing, and disposing of chemicals used during maintenance.
    - Provide adequate ventilation and implement measures to control chemical exposure.
8. **Equipment Inspection:**
    - Conduct thorough inspections of equipment before and after maintenance to identify wear, damage, or potential issues.
    - Address any defects or malfunctions promptly to prevent further damage.
9. **Maintenance Tasks:**
    - Follow manufacturer guidelines and industry best practices for maintenance tasks such as lubrication, calibration, cleaning, and replacement of components.
    - Use proper tools and equipment for the job.
10. **Testing and Quality Control:**
    - Test equipment functionality after maintenance to ensure proper operation and compliance with performance standards.

- Perform quality control checks to verify that maintenance tasks were completed correctly.

11. **Emergency Preparedness:**
    - Be prepared for unexpected events by having emergency response plans and equipment in place.
    - Train maintenance personnel in emergency response procedures.
12. **Post-Maintenance Cleanup:**
    - Clean up work areas and properly dispose of waste materials, chemicals, and used equipment.
    - Leave the area in a safe and clean condition for subsequent operations.
13. **Documentation and Reporting:**
    - Document all maintenance activities, findings, and corrective actions taken.
    - Report any deviations from normal conditions or unexpected incidents to relevant personnel.
14. **Continuous Improvement:**
    - Analyze the effectiveness of maintenance procedures and identify areas for improvement to enhance safety and efficiency.

It's important to tailor maintenance procedures to the specific equipment, processes, and risks present in your chemical plant. Regular review and updates of maintenance procedures based on lessons learned, changes in technology, and regulatory requirements are essential to maintaining a safe and productive chemical plant environment.

ELECTRIC POWER PLANTS AND INDUSTRIAL FASTENERS

Industrial fasteners play a crucial role in electric power plants by ensuring the safe and reliable operation of various equipment and structures. Here are some types of applications within an electric power plant where industrial fasteners are essential:

1. **Turbine Assembly:** Fasteners are used to secure the various components of steam or gas turbines, including blades, casings, and rotor shafts. These fasteners must withstand high temperatures and vibrations.
2. **Piping and Plumbing:** Industrial fasteners, such as bolts, nuts, and flange gaskets, are used to connect and seal the various pipes and plumbing systems that transport water, steam, and other fluids throughout the power plant.
3. **Boiler and Pressure Vessel Construction:** Power plants often have large boilers and pressure vessels. Fasteners are used to assemble and maintain these critical components, ensuring they can handle high-pressure and high-temperature conditions safely.
4. **Electrical Equipment:** Fasteners are used to secure electrical cabinets, panels, and wiring in power plants. They also play a role in mounting generators, transformers, and other electrical equipment.
5. **Structural Supports:** Power plants require a robust infrastructure with structural supports like beams, columns, and platforms. Bolts, anchors, and other fasteners are used to assemble and maintain these structures.
6. **Ductwork and Ventilation Systems:** Fasteners are used to secure ductwork and ventilation systems that help control air quality and temperature within the power plant.
7. **Heat Exchangers:** These devices transfer heat from one fluid to another and often require fasteners to hold their components together and maintain a proper seal.
8. **Instrumentation and Control Systems:** Fasteners are used to mount and secure sensors, control panels, and other instrumentation essential for monitoring and controlling power plant operations.
9. **Safety Systems:** Fasteners play a role in securing safety equipment, such as fire suppression systems, emergency shut-off valves, and access panels.
10. **Environmental Control Equipment:** Power plants use various environmental control systems, including scrubbers and pollution control equipment. Fasteners are used to assemble and maintain these systems.
11. **Conveyor Systems:** Some power plants use conveyor systems for fuel handling and ash removal. Fasteners are used to construct and maintain these systems.
12. **Fencing and Security:** Fasteners secure perimeter fencing and security systems to protect power plant facilities from unauthorized access.

In all of these applications, industrial fasteners are critical for maintaining the structural integrity and safe operation of the power plant. It's essential to choose fasteners that can withstand the specific environmental conditions, including temperature, pressure, and corrosion, that are prevalent in power plant settings. Proper installation and maintenance of these fasteners are also essential to ensure the power plant's long-term reliability and safety.

What procedures and practices should be carried out when using industrial fasteners in an electric power plant?

Using industrial fasteners in an electric power plant requires strict adherence to procedures and practices to ensure safety, reliability, and compliance with industry standards. Here are essential procedures and practices to follow when working with industrial fasteners in a power plant:

1. **Material Selection:** Choose fasteners made from materials suitable for the specific environmental conditions within the power plant, considering factors like temperature, pressure, and corrosion resistance.
2. **Proper Sizing and Load Calculations:** Ensure that the selected fasteners are appropriately sized and have the necessary load-bearing capacity to withstand the loads and stresses they will encounter in their applications.
3. **Quality Control:** Use fasteners that meet industry standards and are manufactured to high-quality specifications. Verify the quality of fasteners through inspection and testing procedures.
4. **Installation Procedures:**
   a. Follow manufacturer's guidelines and industry standards for proper installation techniques.
   b. Ensure that fasteners are tightened to the specified torque values using calibrated tools and equipment.
   c. Use appropriate lubricants and thread-locking compounds, if required.
   d. Pay attention to thread orientation and alignment.
   e. Perform inspections during installation to identify any issues or defects.
5. **Torque Wrench Calibration:** Regularly calibrate torque wrenches and other tightening tools to ensure accurate torque application during fastener installation.
6. **Bolt Tightening Sequence:** When tightening multiple fasteners on a component, follow the recommended tightening sequence to distribute loads evenly and avoid distortion.
7. **Torque and Tension Checks:** After installation, conduct torque and tension checks to verify that fasteners are properly seated and tightened within acceptable tolerances.
8. **Record Keeping:** Maintain detailed records of fastener installation, including torque values, inspection results, and any deviations from the standard procedures.

9. **Inspection and Maintenance:**
   a. Implement a regular inspection and maintenance program to check the condition of fasteners, looking for signs of corrosion, wear, or loosening.
   b. Replace fasteners that show signs of deterioration or have reached their recommended service life.

10. **Environmental Considerations:** Take into account the power plant's environmental conditions, such as high-temperature areas, chemical exposure, or vibration, and choose fasteners that can withstand these conditions.
11. **Training and Certification:** Ensure that personnel responsible for fastener installation and maintenance are adequately trained and certified in the proper procedures and practices.
12. **Safety Measures:** Adhere to safety protocols, including wearing appropriate personal protective equipment (PPE) and following lockout-tagout (LOTO) procedures if fastener maintenance or replacement involves live equipment.
13. **Documentation:** Keep detailed records of all fasteners used in the power plant, including their type, location, and maintenance history. This documentation aids in tracking and managing fastener integrity.
14. **Emergency Response Plan:** Develop an emergency response plan that includes procedures for addressing fastener-related failures or incidents to minimize downtime and ensure the safety of personnel.
15. **Compliance with Standards:** Ensure that all fastener-related procedures and practices comply with industry standards, such as those set by organizations like ASME (American Society of Mechanical Engineers) and ASTM (American Society for Testing and Materials).

By following these procedures and practices, power plant operators can maintain the integrity of industrial fasteners and contribute to the safe and reliable operation of the facility. Regular inspections, proper installation, and adherence to standards are key to achieving these goals.

What safety considerations must be strictly adhered to when using industrial fasteners in an electric power plant?

Safety is of paramount importance when working with industrial fasteners in an electric power plant. Adhering to strict safety considerations is crucial to prevent accidents, injuries, and equipment failures. Here are essential safety considerations that must be strictly followed when using industrial fasteners in a power plant:

1. **Personal Protective Equipment (PPE):**
    - Ensure that all personnel involved in fastener-related work wear appropriate PPE, which may include safety glasses, gloves, helmets, steel-toed boots, hearing protection, and flame-resistant clothing as needed.
2. **Lockout-Tagout (LOTO):**
    - Implement LOTO procedures when working on equipment that is energized or may become energized during fastener-related tasks. Lock and tag equipment to prevent accidental startup.
3. **Fall Protection:**
    - When working at heights, use fall protection equipment such as harnesses, lanyards, and anchor points to prevent falls. Ensure that workers are trained in proper fall protection techniques.
4. **Tool Safety:**
    - Use tools and equipment that are in good working condition and have been properly maintained. Inspect tools before use to ensure they are safe and functional.
5. **Material Handling:**
    - Follow safe material handling practices when transporting and storing fasteners. Use lifting equipment and techniques when dealing with heavy loads.
6. **Fire Safety:**
    - Be aware of the fire risks associated with power plants. Store fasteners away from flammable materials and follow fire safety protocols.
7. **Hazardous Materials:**
    - If fastener-related work involves hazardous materials or chemicals, ensure that workers are trained in handling and disposing of these substances safely.
8. **Hot Work Permit:**
    - Obtain a hot work permit when performing tasks that involve welding, grinding, or other hot work near flammable or sensitive areas. Follow established safety procedures for hot work.
9. **Confined Space Entry:**
    - If working in confined spaces, adhere to confined space entry procedures, including proper ventilation, monitoring, and rescue plans.
10. **Electrical Safety:**
    - When working near electrical equipment, follow electrical safety protocols, including lockout-tagout procedures, to prevent electrical shock or arc flash incidents.
11. **Emergency Response:**
    - Ensure that workers are trained in emergency response procedures, including evacuation and first aid, in case of accidents or injuries.

12. **Safe Work Practices:**
    - Train personnel in safe work practices related to industrial fasteners, including proper lifting techniques, hand tool safety, and the use of safety equipment.
13. **Proper Ventilation:**
    - In areas where fastener-related work may generate fumes, dust, or gases, maintain adequate ventilation to prevent exposure to hazardous substances.
14. **Communication:**
    - Establish clear communication channels among workers involved in fastener-related tasks to ensure everyone is aware of safety procedures and potential hazards.
15. **Documentation:**
    - Maintain accurate records of safety inspections, training, and incident reports. Use these records to continually improve safety practices.
16. **Safety Audits and Inspections:**
    - Conduct regular safety audits and inspections to identify potential hazards and address them promptly.
17. **Emergency Equipment:**
    - Ensure that fire extinguishers, first-aid kits, and emergency eye wash stations are readily accessible and regularly inspected.
18. **Safety Training:**
    - Provide comprehensive safety training for all personnel involved in fastener-related work to ensure they are aware of potential hazards and know how to respond in emergency situations.

By strictly adhering to these safety considerations and fostering a culture of safety in the power plant, you can help minimize the risks associated with using industrial fasteners and create a safer work environment for all personnel.

What could be the repercussions if the safety guidelines are not followed in an electric power plant?

Failure to follow safety guidelines in an electric power plant can lead to serious repercussions, including:

1. **Accidents and Injuries:** One of the most immediate and severe consequences of not following safety guidelines is the risk of accidents and injuries to workers. These injuries can range from minor cuts and bruises to severe burns, electrical shocks, falls from heights, and even fatalities.

2. **Damage to Equipment:** Neglecting safety protocols can lead to equipment damage, including damage to industrial fasteners themselves. Improper installation or maintenance can result in fastener failures, which may cause equipment breakdowns, costly repairs, and production downtime.
3. **Environmental Incidents:** Power plants often handle hazardous materials and chemicals. Failure to follow safety guidelines can lead to leaks, spills, or emissions, causing environmental pollution and regulatory violations. Cleanup costs and fines can be substantial.
4. **Financial Losses:** Accidents and equipment failures can result in significant financial losses due to repair costs, replacement of damaged equipment, insurance claims, and production interruptions.
5. **Legal Consequences:** Non-compliance with safety regulations may lead to legal actions, including fines, penalties, and lawsuits. Failure to meet safety standards can also result in regulatory sanctions, shutdown orders, and revocation of operating licenses.
6. **Reputation Damage:** Incidents related to safety violations can harm the reputation of the power plant and the company that operates it. This can impact relationships with customers, investors, and regulatory authorities.
7. **Worker Morale:** A lack of safety compliance can lower employee morale and job satisfaction, leading to decreased productivity, higher turnover rates, and difficulties in recruiting new talent.
8. **Increased Insurance Costs:** Frequent accidents and safety violations can lead to higher insurance premiums, increasing the overall operating costs of the power plant.
9. **Loss of Life:** The most tragic consequence of failing to follow safety guidelines is the loss of human life. Accidents in power plants have the potential to cause fatalities among workers or nearby communities.
10. **Operational Delays:** Safety incidents often result in operational delays as investigations, cleanup, and repairs are conducted. These delays can disrupt the power generation process and affect the supply of electricity to customers.
11. **Public and Regulatory Scrutiny:** Safety incidents can lead to increased scrutiny from regulatory authorities, the media, and the public, which can further damage the reputation of the power plant and its operators.
12. **Increased Liability:** Failure to adhere to safety guidelines may increase liability for the power plant and its operators in the event of accidents, injuries, or environmental damage.

To avoid these repercussions, power plants must prioritize safety by implementing and enforcing strict safety guidelines, providing comprehensive training, conducting regular safety audits, and fostering a culture of safety among all employees and contractors. Safety should always be a top priority in the operation and maintenance of electric power plants to protect both personnel and the environment.

FASTENER USE IN THE OFFSHORE OIL & GAS INDUSTRY

Industrial fasteners play a critical role in the offshore oil and gas industry in drilling, production, and transportation operations. These fasteners are essential for ensuring the integrity, safety, and reliability of equipment and infrastructure in the harsh and demanding offshore environment. Here's a breakdown of their significance in each of these phases:

1. **Drilling Phase**:
   - **Subsea Equipment**: Offshore drilling often involves the installation of subsea equipment, such as blowout preventers, wellheads, and risers. Industrial fasteners are used to secure and connect various components, ensuring they can withstand high pressures, extreme temperatures, and corrosive seawater.
   - **Platform Construction**: When constructing offshore drilling platforms, fasteners are used to assemble the various structural components, including the platform's jacket, decks, and support structures. These fasteners need to withstand environmental conditions like saltwater corrosion and heavy loads.
2. **Production Phase**:
   - **Pipeline Systems**: Offshore production facilities include extensive pipeline systems to transport oil and gas from the seabed to the processing facility or onshore. Industrial fasteners are used to join and secure pipeline sections and associated infrastructure, such as valves and connectors.
   - **Equipment Maintenance**: Routine maintenance and repair of production equipment often require fasteners to replace worn or damaged parts. Fasteners must be durable and resistant to corrosion to ensure the continued operation of the facility.
3. **Transportation Phase**:
   - **Offshore Platforms**: Fasteners are critical in securing equipment and structures on offshore platforms during transportation to their deployment location. They must withstand the stresses of ocean transport and ensure that the platform arrives intact.

- **Shipping and Logistics**: Fasteners are used in various aspects of shipping and logistics for the oil and gas industry, including securing cargo on supply vessels and securing equipment for transportation to and from offshore sites.
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Key considerations for industrial fasteners in the offshore oil and gas industry include:

- **Corrosion Resistance**: Due to the corrosive nature of saltwater, fasteners are typically made from materials like stainless steel or corrosion-resistant alloys to ensure they maintain their integrity over time.
- **Strength and Reliability**: Fasteners used in offshore applications must meet stringent strength and reliability standards to withstand the challenging environmental conditions and operational demands.
- **Safety**: The integrity of fasteners directly affects the safety of offshore operations. Any failure can lead to catastrophic incidents, making proper selection and installation crucial.
- **Environmental Compliance**: Offshore oil and gas operations often operate in ecologically sensitive areas, so fasteners must meet environmental regulations to prevent pollution or damage to marine ecosystems.

In summary, industrial fasteners are essential components in the offshore oil and gas industry, playing a vital role in ensuring the safety, reliability, and longevity of infrastructure and equipment used in drilling, production, and transportation operations in the challenging offshore environment.

How are fasteners used in the above applications and what is the procedure?

The use of fasteners in offshore oil and gas applications involves securing and connecting various components and structures to ensure safety, structural integrity, and operational reliability. The specific procedures for using fasteners vary depending on the application, but here are some common ways they are used and the general procedures involved:

1. **Subsea Equipment Installation**:
   - **Procedure**:
     - Select fasteners made from corrosion-resistant materials like stainless steel or alloy steel to withstand the corrosive seawater environment.
     - Properly torque fasteners to manufacturer-specified values to ensure a secure and leak-free connection.
     - Use sealing techniques such as gaskets and seals to prevent leaks.
     - Inspect fasteners regularly for signs of corrosion or wear and replace them as needed during maintenance.
2. **Platform Construction**:
   - **Procedure**:
     - Use fasteners to assemble structural components of the platform, including the jacket, decks, and support structures.
     - Follow engineering drawings and specifications to determine the correct types and sizes of fasteners for each connection.
     - Employ proper torqueing procedures and tools to ensure that fasteners are tightened to the specified levels.
     - Conduct quality control inspections to verify the integrity of fastened connections.
3. **Pipeline Systems**:
   - **Procedure**:
     - Select fasteners that are compatible with the materials of the pipeline, such as carbon steel or alloy steel fasteners for use with steel pipelines.
     - Bolt together pipeline sections and associated components using appropriate gaskets or sealing materials.
     - Tighten fasteners to the recommended torque levels to prevent leaks.
     - Inspect pipeline fasteners for corrosion and perform regular maintenance to replace damaged or worn fasteners.
4. **Equipment Maintenance**:
   - **Procedure**:
     - During maintenance and repair activities, follow manufacturer guidelines for fastener replacement or re-torquing.

- Use appropriate torque wrenches or tensioning tools to achieve the required tightness.
- Ensure that fasteners are properly aligned and engage with their corresponding components to prevent stress or misalignment issues.

5. **Offshore Platform Transportation**:
   - **Procedure**:
     - Secure equipment, components, and structures on the platform using fasteners to prevent movement or damage during transportation.
     - Verify that fasteners are correctly tightened and that safety measures are in place to prevent loosening or dislodging during transit.
     - Use appropriate materials and techniques to secure fasteners, considering the dynamic forces encountered during transport.
6. **Shipping and Logistics**:
   - **Procedure**:
     - Secure cargo and equipment on supply vessels or transport vessels using fasteners, tie-downs, and restraints to prevent shifting or damage during transit.
     - Follow shipping and logistics guidelines for proper loading and securing procedures.
     - Inspect fasteners before and after transit to ensure they remain secure and intact.

In all these applications, safety is paramount, and fasteners must be installed and maintained with precision and care. Deviating from recommended procedures or using incorrect fasteners can lead to structural failures, leaks, or safety hazards in the offshore oil and gas industry. Consequently, adherence to industry standards and best practices is crucial throughout the fastening process.

What maintenance considerations must be in place when using fasteners in the above applications?

Maintenance considerations for fasteners in offshore oil and gas applications are critical to ensuring the continued safety and reliability of equipment and structures. Proper maintenance practices help prevent corrosion, degradation, and mechanical failures that can compromise the integrity of fastened connections. Here are some key maintenance considerations:

1. **Corrosion Protection**:
   - Offshore environments are highly corrosive due to exposure to saltwater and harsh weather conditions. Regular inspections for corrosion are essential.
   - Consider using corrosion-resistant fasteners (e.g., stainless steel or coated fasteners) to extend their service life.
   - Implement corrosion prevention measures, such as protective coatings, cathodic protection systems, and regular cleaning and washing of fasteners and structures.
2. **Inspections**:
   - Establish a routine inspection schedule for all fastened connections, including subsea equipment, pipelines, and platform structures.
   - Inspect fasteners for signs of corrosion, wear, or damage, such as rust, pitting, or loosening.
   - Use non-destructive testing (NDT) methods like ultrasonic testing or magnetic particle inspection when necessary to assess the integrity of critical fasteners.
3. **Tightening and Torque Checks**:
   - Verify the torque of fasteners regularly, especially in critical applications like subsea equipment and pipeline connections.
   - Conduct torque checks after equipment installation, maintenance, and as part of routine inspections to ensure fasteners remain properly tightened.
4. **Fastener Replacement**:
   - Establish criteria for fastener replacement based on inspection results, corrosion levels, and wear.
   - Replace fasteners that no longer meet safety or performance standards promptly.
   - Use proper procedures and torque values when installing replacement fasteners.
5. **Sealing and Gaskets**:

- Inspect and replace sealing materials and gaskets as needed to prevent leaks.
- Ensure that fasteners are correctly installed with the appropriate seals to maintain pressure integrity.

6. **Documentation and Record-Keeping**:
   - Maintain detailed records of all fasteners, including type, material, installation dates, and inspection results.
   - Keep records of torque values used during installation and maintenance.
   - Use asset management software or systems to track the maintenance history of fasteners and associated equipment.
7. **Environmental Monitoring**:
   - Monitor environmental conditions, such as temperature, humidity, and saltwater exposure, that can impact fastener performance.
   - Implement measures to mitigate environmental effects on fasteners, such as protective coatings and maintenance schedules based on environmental data.
8. **Training and Procedures**:
   - Ensure that personnel involved in fastener maintenance are adequately trained in best practices, safety protocols, and relevant procedures.
   - Regularly update maintenance procedures based on industry standards and lessons learned from past incidents or failures.
9. **Emergency Response**:
   - Develop and maintain emergency response plans for addressing fastener-related issues, such as leaks or structural failures.
   - Train personnel on emergency procedures to address fastener failures promptly and safely.

By implementing these maintenance considerations, offshore oil and gas operators can maximize the lifespan and reliability of fasteners, reducing the risk of equipment failures and ensuring the safety of personnel and the environment. Compliance with industry standards and regulations is crucial to maintaining the integrity of fastened connections in these critical applications.

What safety considerations must be examined when using industrial fasteners in the above applications and procedures?

Safety considerations are paramount when using industrial fasteners in offshore oil and gas applications and procedures. Failure to address safety concerns can lead to accidents, equipment failures, environmental damage, and potentially catastrophic consequences. Here are some key safety considerations that must be examined:

1. **Material Selection**:
   - Ensure that fasteners are made from materials suitable for the specific application and environment. In offshore environments, corrosion-resistant materials like stainless steel or specialty alloys are often necessary.
2. **Proper Torque and Tension**:
   - Follow manufacturer-recommended torque values and procedures during fastener installation and maintenance to ensure proper clamping force.
   - Over-tightening or under-tightening can lead to fastener failures, so precise torque control is essential.
3. **Thread Integrity**:
   - Verify the integrity of fastener threads during installation and inspections to prevent thread stripping, which can compromise the fastener's strength.
4. **Sealing and Leak Prevention**:
   - Ensure that fasteners used in critical applications (e.g., subsea equipment and pipeline connections) are sealed properly to prevent leaks and maintain pressure integrity.
5. **Handling and Storage**:
   - Train personnel in safe handling practices for fasteners to prevent injuries.
   - Store fasteners in a clean, dry, and protected environment to prevent contamination and corrosion.
6. **Environmental Protection**:

- Implement measures to protect fasteners from the corrosive effects of seawater, including the use of coatings and cathodic protection systems.
- Take precautions to minimize environmental impact, such as preventing oil spills or chemical leaks caused by fastener failures.

7. **Quality Control and Inspection**:
    - Establish rigorous quality control and inspection procedures to verify the integrity of fastened connections.
    - Regularly inspect fasteners for signs of corrosion, wear, or damage.
8. **Emergency Response**:
    - Develop and communicate emergency response plans for addressing fastener-related incidents, including leaks or equipment failures.
    - Train personnel on emergency procedures and response protocols.
9. **Personnel Safety**:
    - Ensure that workers involved in fastener-related tasks receive proper safety training, including the use of personal protective equipment (PPE).
    - Implement fall protection measures when working at heights, such as during platform construction or maintenance.
10. **Documentation and Records**:
    - Maintain detailed records of fastener specifications, installation procedures, torque values, and inspection results.
    - Ensure that all relevant personnel have access to this documentation for reference and compliance.
11. **Compliance with Regulations**:
    - Adhere to industry standards, regulations, and best practices related to fastener installation, maintenance, and safety.
    - Stay up to date with changes in safety standards and regulations that apply to offshore oil and gas operations.
12. **Training and Competency**:
    - Continuously train and assess the competency of personnel involved in fastener-related tasks to ensure that they are aware of safety protocols and best practices.
13. **Risk Assessment**:
    - Conduct risk assessments to identify potential hazards associated with fasteners and take measures to mitigate those risks.

14. **Communication and Reporting**:
    - Foster a culture of open communication where workers feel comfortable reporting safety concerns or incidents related to fasteners promptly.

By addressing these safety considerations, offshore oil and gas operators can minimize the risks associated with industrial fasteners and create a safer working environment for their personnel while safeguarding the environment and assets. Safety should always be a top priority in offshore operations.

FASTENERS IN NUCLEAR POWER PLANT FACILITIES

Industrial fasteners used in nuclear power plants and their surrounding support facilities must meet stringent safety and quality standards due to the critical nature of nuclear operations. These fasteners are essential for securing various components, structures, and systems in the plant. Here are some of the common types of industrial fasteners used in nuclear power plants:

1. **Stainless Steel Bolts and Nuts:** Stainless steel fasteners are often used due to their corrosion resistance, which is crucial in a nuclear environment where exposure to moisture and radiation can degrade materials over time.
2. **High-Strength Bolts:** Bolts with high tensile strength are essential for fastening heavy components and structural elements in the plant. These bolts need to withstand extreme loads and maintain their integrity over time.
3. **Socket Head Cap Screws:** These screws are used in various applications throughout a nuclear facility, such as securing instrumentation and control systems, electrical components, and safety equipment.
4. **Threaded Rods:** Threaded rods are used for various purposes, including supporting heavy equipment, anchoring structures to the foundation, and constructing pipe supports.
5. **Washers and Locknuts:** These components are used in conjunction with bolts and screws to ensure proper fastening and prevent loosening due to vibration or thermal cycling.
6. **Anchors and Expansion Bolts:** These are used to secure equipment to concrete surfaces or structures. They provide stability and prevent movement during operational or seismic events.
7. **Stud Bolts:** Stud bolts are often used for flange connections in piping systems, which are prevalent in nuclear power plants. They ensure leak-free connections in high-pressure and high-temperature environments.
8. **Cable Ties and Clamps:** These are used for organizing and securing electrical and instrumentation cables, ensuring safety and easy maintenance.
9. **Weld Studs:** Weld studs are used in various welding applications within nuclear facilities, providing a means to secure components and structures permanently.

10. **Specialty Fasteners:** Some fasteners are custom-designed to meet specific requirements in nuclear power plants. These may include fasteners with radiation-resistant coatings or materials and those with special geometries for unique applications.

All fasteners used in nuclear power plants are subject to strict quality control and inspection processes. They need to meet industry standards and regulatory requirements to ensure the safety and reliability of the plant's operation. Additionally, nuclear facilities have rigorous maintenance and inspection programs to monitor and replace fasteners as needed to prevent failures that could compromise safety.

What type equipment/assets use industrial fasteners in nuclear power plants and the surrounding support facilities?

Industrial fasteners are used in a wide range of equipment and assets in nuclear power plants and their surrounding support facilities. These fasteners play a crucial role in ensuring the structural integrity, safety, and proper functioning of various components and systems. Here are some examples of equipment and assets that commonly use industrial fasteners in nuclear power plants and related facilities:

1. **Reactor Components:**
   - Reactor vessel and coolant system components.
   - Control rod drive mechanisms.
   - Pressure vessel heads and closures.
2. **Piping Systems:**
   - Pipe flanges, valves, and fittings.
   - Supports and hangers for piping.
   - Heat exchangers and steam generators.
3. **Turbine Generators:**
   - Bolts and fasteners for securing turbine blades and rotor assemblies.
   - Mounting and support structures for turbines and generators.
4. **Electrical Systems:**
   - Fasteners for electrical panel installations.

- Cable trays, conduits, and supports.
- Securement of electrical equipment and control cabinets.

5. **Instrumentation and Control Systems:**
    - Mounting of sensors, transmitters, and control devices.
    - Fasteners for instrument panels and control consoles.
6. **Cooling Systems:**
    - Fasteners for cooling tower components.
    - Securement of pumps, heat exchangers, and cooling system infrastructure.
7. **Safety Systems:**
    - Fasteners for safety relief valves and emergency shutdown systems.
    - Attachment of safety barriers and shielding.
8. **Structural Components:**
    - Steel beams, columns, and support structures.
    - Fasteners for the building's structural integrity.
    - Concrete anchoring systems.
9. **Radiation Shielding:**
    - Fasteners used in the construction of radiation shielding walls and structures.
    - Attachment of lead or concrete shielding materials.
10. **Storage and Containment Systems:**
    - Fasteners for securing radioactive waste containers and storage systems.
    - Attachment of containment vessels and barriers.
11. **Maintenance and Inspection Equipment:**
    - Fasteners used in the construction of inspection platforms and access equipment for maintenance and repairs.
12. **Auxiliary Systems:**
    - Fasteners for auxiliary equipment, including pumps, compressors, and HVAC systems.
    - Attachment of components in water treatment and filtration systems.
13. **Fire Suppression and Safety Equipment:**
    - Mounting of fire suppression systems.
    - Fasteners for safety showers, eyewash stations, and emergency response equipment.

These are just a few examples, and the use of industrial fasteners extends to virtually every aspect of a nuclear power plant and its support facilities. The reliability and safety of these fasteners are of utmost importance to ensure the overall integrity and functionality of nuclear facilities, as any failure could have serious consequences. Therefore, strict quality control, inspection, and maintenance protocols are in place to monitor and replace fasteners as needed.

What are the procedures for using industrial fasteners in each of the components above?

The procedures for using industrial fasteners in various components within nuclear power plants and their surrounding support facilities are highly regulated and follow strict guidelines to ensure safety and reliability. Here's a general overview of the procedures for using industrial fasteners in each of the mentioned components:

1. **Reactor Components:**
    - Fasteners used in reactor components are typically subject to stringent quality control standards. Detailed specifications and torque values are provided by the manufacturer or engineering design.
    - Proper installation procedures, including torque wrench calibration, are followed to ensure that fasteners are tightened to the specified torque levels.
    - Inspections and non-destructive testing may be conducted to verify the integrity of critical fasteners.
2. **Piping Systems:**
    - Flange connections require careful alignment and gasket selection. The fasteners are installed in a specific pattern to evenly distribute pressure and prevent leaks.
    - Proper torque values and tightening sequences are followed to achieve a leak-tight seal without damaging the flanges or fasteners.
    - Inspections may include visual checks and ultrasonic testing of critical connections.
3. **Turbine Generators:**

- Bolts used in turbine assemblies and rotor components are subject to precise torque specifications to maintain balance and ensure safety.
- Fasteners are carefully torqued and secured according to manufacturer recommendations and engineering guidelines.
- Regular inspections may be conducted to monitor fastener integrity and detect any issues.

4. **Electrical Systems:**
   - Fasteners for electrical equipment are installed according to manufacturer instructions, taking into account electrical clearances and proper grounding.
   - Torque values are specified to ensure a secure electrical connection without over-tightening, which can damage components.
   - Electrical safety protocols are followed to prevent electrical hazards during installation.
5. **Instrumentation and Control Systems:**
   - Fasteners used for mounting instruments and control devices follow engineering drawings and specifications.
   - Care is taken to prevent over-tightening, which could affect the accuracy of instruments.
   - Proper cable management and securement are essential to avoid interference with control systems.
6. **Cooling Systems:**
   - Fasteners used in cooling systems are installed according to design and manufacturer instructions.
   - Proper torque values are applied to maintain the integrity of components such as heat exchangers and pumps.
   - Inspections may include checks for leaks and signs of corrosion.
7. **Safety Systems:**
   - Fasteners for safety systems must meet strict quality and reliability standards.
   - Installation follows manufacturer guidelines, and regular inspections are conducted to ensure that safety systems are ready for immediate activation when needed.
8. **Structural Components:**
   - Structural fasteners are installed as per engineering drawings and specifications.

- Bolted connections may require periodic inspections for signs of wear or corrosion, especially in seismic areas.

9. **Radiation Shielding:**
    - Fasteners used in radiation shielding structures are installed according to detailed plans and calculations.
    - The shielding material and fasteners are selected to provide the required protection levels.
    - Regular inspections ensure that shielding integrity is maintained.
10. **Storage and Containment Systems:**
    - Fasteners for radioactive waste containers and storage systems follow strict protocols to prevent leaks or contamination.
    - Inspections are performed to verify the integrity of containment systems.
11. **Maintenance and Inspection Equipment:**
    - Installation of fasteners for inspection platforms and access equipment follows engineering guidelines to ensure worker safety.
    - Regular inspections of access equipment are essential to detect wear or damage.
12. **Auxiliary Systems:**
    - Fasteners for auxiliary equipment are installed according to manufacturer recommendations and design specifications.
    - Routine maintenance and inspections are conducted to keep auxiliary systems in proper working order.
13. **Fire Suppression and Safety Equipment:**
    - Fasteners for fire suppression and safety equipment are installed as per manufacturer guidelines and safety standards.
    - Routine inspections are carried out to ensure the equipment remains operational.

In all cases, safety is paramount, and quality control measures, including documentation, inspections, and testing, are implemented to ensure that fasteners perform their intended function without compromise. Additionally, plant personnel receive training on proper fastener installation procedures and safety protocols to maintain the reliability of these critical components.

What maintenance involving fasteners is necessary for each of the above components?

Maintenance involving fasteners in nuclear power plants and their associated facilities is crucial to ensure the ongoing safety and reliability of the components and systems they secure. Here's an overview of the maintenance tasks typically associated with fasteners in each of the mentioned components:

1. **Reactor Components:**
   - Regular inspections of fasteners in reactor components are performed to detect any signs of corrosion, stress, or deformation.
   - Periodic re-torquing or re-tightening of critical fasteners may be required to maintain their integrity.
   - Non-destructive testing (e.g., ultrasound) may be conducted to assess the condition of critical fasteners.
2. **Piping Systems:**
   - Routine inspections of fasteners in piping systems are conducted to check for signs of corrosion, leakage, or loose connections.
   - Gasket and sealing components are inspected, and gaskets are replaced when necessary.
   - Bolts and nuts are re-torqued as part of preventive maintenance to ensure proper sealing and safety.
3. **Turbine Generators:**
   - Bolts and fasteners in turbine generators are periodically inspected for signs of wear, corrosion, or stress.
   - Critical torque values are monitored, and fasteners are re-tightened if necessary to maintain balance and safety.
4. **Electrical Systems:**
   - Regular visual inspections of fasteners in electrical systems are performed to ensure they remain secure and corrosion-free.
   - Grounding connections are inspected for proper contact and electrical continuity.
5. **Instrumentation and Control Systems:**

- Fasteners used in mounting instruments and control devices are inspected for tightness and integrity during routine maintenance checks.
- Wiring and cable connections are examined for damage or signs of wear.

6. **Cooling Systems:**
   - Inspections of fasteners in cooling systems focus on preventing leaks and ensuring proper thermal transfer.
   - Gaskets and seals are checked for wear and replaced as needed.
   - Bolts securing pumps and heat exchangers are inspected for tightness.
7. **Safety Systems:**
   - Fasteners in safety systems undergo regular inspections and testing to verify their readiness for immediate activation.
   - Any damaged or compromised fasteners are replaced promptly to ensure safety system reliability.
8. **Structural Components:**
   - Structural fasteners are inspected for signs of corrosion, fatigue, or wear.
   - Periodic re-torquing of critical connections may be required to maintain structural integrity.
9. **Radiation Shielding:**
   - Fasteners used in radiation shielding structures are inspected for corrosion and structural soundness.
   - Shielding material integrity is monitored to ensure the continued effectiveness of radiation protection.
10. **Storage and Containment Systems:**
    - Fasteners in storage and containment systems are inspected to ensure they remain leak-tight and secure.
    - Periodic inspections of containment vessels and structures are carried out to identify any issues with fasteners.
11. **Maintenance and Inspection Equipment:**
    - Fasteners on inspection platforms and access equipment are inspected for signs of wear or damage.
    - Routine maintenance tasks include lubrication of moving parts and replacement of worn components.

12. **Auxiliary Systems:**
    - Fasteners in auxiliary systems are inspected for tightness and corrosion.
    - Maintenance and replacement of fasteners follow manufacturer recommendations and design specifications.
13. **Fire Suppression and Safety Equipment:**
    - Fasteners securing fire suppression and safety equipment are inspected for integrity.
    - Routine maintenance tasks include checking for proper functioning of safety systems.

In all cases, maintenance involving fasteners should be carried out in accordance with established maintenance procedures and schedules, which are typically based on industry standards and regulatory requirements. The goal is to detect and address any issues with fasteners before they lead to equipment failure or compromise safety. Proper documentation of maintenance activities is also essential for regulatory compliance and traceability.

What safety considerations are involved when using industrial fasteners in nuclear power plants and it's surrounding facilities?

Safety considerations when using industrial fasteners in nuclear power plants and their surrounding facilities are of paramount importance due to the critical nature of these environments. Failure of fasteners can lead to catastrophic consequences, including the release of radiation, equipment malfunctions, or structural failures. Here are key safety considerations:

1. **Material Selection:**
    - Choose fasteners made of materials that can withstand the specific environmental conditions, including radiation exposure, temperature extremes, and corrosion resistance.
2. **Quality Control:**
    - Ensure that fasteners meet rigorous quality control standards and are procured from reputable suppliers.

- Implement quality assurance programs to verify the integrity and reliability of fasteners.

3. **Proper Torque and Tightening:**
   - Follow manufacturer-recommended torque values and tightening sequences for fasteners to avoid under-tightening or over-tightening, which can compromise their integrity.
   - Use calibrated torque wrenches to achieve accurate torque levels.
4. **Inspection and Testing:**
   - Regularly inspect fasteners for signs of wear, corrosion, or deformation.
   - Conduct non-destructive testing (e.g., ultrasound, radiography) to assess the condition of critical fasteners.
   - Implement preventive maintenance schedules to ensure ongoing fastener reliability.
5. **Documentation and Traceability:**
   - Maintain detailed records of all fastener installations, inspections, and maintenance activities.
   - Ensure traceability of fasteners to track their origin, material properties, and usage history.
6. **Safety Training:**
   - Train personnel involved in fastener installation and maintenance on safety protocols and proper procedures.
   - Emphasize radiation safety measures, especially when working in areas with potential radiation exposure.
7. **Radiation Shielding:**
   - Implement appropriate radiation shielding measures for workers handling fasteners in radioactive areas.
   - Provide protective clothing and equipment as needed to minimize radiation exposure risks.
8. **Contamination Control:**
   - Establish strict contamination control procedures to prevent contamination of fasteners and surrounding components.
   - Use clean rooms or controlled environments for fastener handling when necessary.
9. **Sealing and Gasket Integrity:**

- Ensure the integrity of sealing gaskets and components in flanged connections to prevent leakage of hazardous substances.
- Conduct leak testing as part of maintenance and inspection routines.

10. **Seismic Considerations:**
    - In seismic zones, fasteners must be designed and installed to withstand earthquake forces.
    - Regularly inspect fasteners in seismic applications to ensure they remain secure.
11. **Fire Safety:**
    - Ensure fasteners used in fire suppression systems and safety equipment are fire-resistant and maintain their integrity during fire events.
12. **Emergency Response:**
    - Develop emergency response plans for fastener-related incidents, including procedures for containment, cleanup, and radiation monitoring in case of fastener failure.
13. **Regulatory Compliance:**
    - Comply with all nuclear safety regulations and standards relevant to fastener installation, maintenance, and documentation.
14. **Communication:**
    - Foster clear communication and reporting channels to promptly address any fastener-related safety concerns or incidents.
15. **Human Factors:**
    - Address potential human factors issues, such as fatigue, distractions, and complacency, which can impact fastener installation and maintenance.
16. **Continuous Improvement:**
    - Encourage a culture of continuous improvement and lessons learned to enhance fastener safety practices over time.

Safety in nuclear power plants and related facilities is a multidisciplinary effort that involves rigorous protocols, ongoing training, and a strong commitment to maintaining the highest safety standards. The goal is to prevent fastener-related failures and ensure the overall safety and reliability of these critical systems.

Being that it is a nuclear power plant, what are the ramifications of a failure to meet all the safety requirements when using fasteners?

A failure to meet all the safety requirements when using fasteners in a nuclear power plant can have severe and far-reaching consequences. Given the inherent risks associated with nuclear power, safety is of paramount importance, and any lapses or failures can lead to a range of ramifications, including:

1. **Radiation Release:** The most significant concern is the potential release of radioactive materials. If fasteners fail in critical systems, such as reactor coolant systems or containment structures, it can result in the release of radioactive gases or fluids into the environment, endangering workers, the public, and the environment.
2. **Equipment Malfunctions:** Fastener failures can lead to malfunctions or shutdowns of essential equipment, such as reactor coolant pumps or safety systems. This can disrupt power generation, compromise safety systems, and result in unplanned outages.
3. **Structural Failures:** Inadequate fastener integrity in structural components can lead to structural failures. This can impact the safety of personnel and the plant's ability to withstand external events like earthquakes or extreme weather.
4. **Safety System Failures:** Fastener failures in safety-critical systems, such as emergency core cooling or containment systems, can render these systems ineffective during accidents or incidents, increasing the risk of a nuclear accident.
5. **Regulatory Sanctions:** Regulatory agencies (e.g., the Nuclear Regulatory Commission in the United States) enforce strict safety standards for nuclear facilities. Failure to meet safety requirements, including those related to fasteners, can result in regulatory sanctions, fines, or the temporary or permanent shutdown of the plant.
6. **Legal Liabilities:** The plant operator and personnel responsible for safety may face legal liabilities and lawsuits in the event of a nuclear incident or release of radioactive materials due to fastener failures. This can lead to significant financial consequences.

7. **Environmental Contamination:** A fastener-related failure can lead to environmental contamination in the vicinity of the nuclear facility, affecting soil, water, and air quality. Cleanup efforts can be costly and time-consuming.
8. **Health Impacts:** Radiation exposure resulting from a fastener-related incident can have serious health consequences for workers, nearby communities, and emergency responders.
9. **Loss of Public Trust:** A safety-related incident can erode public trust in the nuclear industry and the plant operator. It can lead to public opposition to nuclear power and difficulties in obtaining permits for future projects.
10. **Long-Term Cleanup and Remediation:** Addressing the aftermath of a nuclear incident can require extensive cleanup and remediation efforts, which can take decades and be extremely expensive.
11. **International Consequences:** Depending on the severity of the incident, it may lead to international scrutiny, diplomatic tensions, and impacts on international agreements related to nuclear safety and non-proliferation.

In summary, failing to meet safety requirements when using fasteners in a nuclear power plant can result in catastrophic consequences, including radiological releases, equipment failures, regulatory actions, legal liabilities, and significant environmental and health impacts. The nuclear industry places an utmost emphasis on safety to prevent such events and mitigate their consequences if they occur.

FASTENERS USE IN OIL, WATER, AND NATURAL GAS PIPELINE INDUSTRIES

Fasteners play a crucial role in the pipeline industry for oil, natural gas, and water transportation systems. They are used to join various components of pipelines, ensuring structural integrity, leak prevention, and overall safety. Here are some ways in which fasteners are used in the pipeline industry:

1. **Flange Connections:** Flanges are commonly used to connect pipeline sections, valves, and other components. Fasteners such as bolts and nuts are used to secure the flanges together, creating a sealed joint. These connections are critical for preventing leaks and maintaining pipeline integrity.
2. **Pipeline Supports:** Fasteners are used to secure support structures, such as pipe hangers and clamps, to hold the pipeline in place. This helps to distribute the weight of the pipeline and prevent sagging or movement due to external factors like vibrations or temperature changes.
3. **Valve and Fitting** Connections: Valves, fittings, and other components within the pipeline system are connected to the main pipeline using fasteners. This ensures that these components are securely attached and can be easily accessed for maintenance or replacement.
4. **Corrosion Control:** Fasteners made from corrosion-resistant materials, such as stainless steel, are used in pipelines to prevent rust and deterioration. Corrosion can weaken the fasteners and the pipeline structure, so selecting the right materials is crucial for long-term reliability.
5. **Flange Insulation** Kits: In some applications, where electrical insulation is required to prevent galvanic corrosion or for safety reasons, flange insulation kits are used. These kits include gaskets, insulating sleeves, and fasteners designed to maintain electrical isolation between flanges.
6. **Repair and Maintenance:** Fasteners are essential for pipeline repair and maintenance activities. They are used to replace damaged components, reinforce weakened sections, or reassemble parts after inspection or maintenance work.
7. **Pressure Containment:** Fasteners in critical areas of a pipeline, such as at high-pressure points, are designed to provide a secure and reliable seal. Proper torque and installation procedures are crucial to ensuring pressure containment and safety.

8. **Expansion and Contraction:** Pipelines are subject to thermal expansion and contraction due to temperature fluctuations. Expansion joints and flexible couplings, which use fasteners for connection, are employed to accommodate these movements and prevent stress on the pipeline.
9. **Leak Prevention:** Fasteners are used in conjunction with sealing materials like gaskets to create leak-tight connections between pipeline components. This is especially important for hazardous materials like oil and natural gas to prevent environmental damage and safety hazards.
10. **Quality Control:** Fasteners used in the pipeline industry must meet strict quality and performance standards. Manufacturers and operators conduct regular inspections and tests to ensure the integrity of fasteners and their connections.

In summary, fasteners are essential components in the pipeline industry for oil, natural gas, and water transportation systems. They are used to create strong, reliable connections, prevent leaks, support the pipeline structure, and ensure the safety and integrity of the entire system. The selection of appropriate materials and proper installation procedures are critical to the success of these fastener applications in pipelines.

What procedures are used for securing fasteners in the above applications?

Securing fasteners in pipeline applications requires careful procedures to ensure proper installation, prevent leaks, and maintain the integrity and safety of the system. Here are some common procedures used for securing fasteners in the pipeline industry:

1. **Proper Torque Application:** Applying the correct torque to bolts and nuts is essential to achieve a secure and leak-free connection. Under-tightened fasteners can result in leaks, while over-tightening can damage components or cause stress on the pipeline. Torque wrenches and calibrated tools are used to achieve the specified torque values provided by the manufacturer or engineering standards.
2. **Bolt and Nut Inspection:** Before installation, bolts and nuts should be inspected for defects, corrosion, or damage. Damaged or worn fasteners should be replaced to ensure a reliable connection.

3. **Thread Lubrication:** Applying an appropriate thread lubricant or anti-seize compound to the threads of bolts and nuts can aid in achieving the desired torque and prevent galling or seizing during installation.
4. **Proper Gasket Installation:** When gaskets are used to create a seal between flanges or other components, they must be correctly positioned and aligned. Gaskets should be selected based on material compatibility and service conditions.
5. **Sequential Tightening:** In flange connections with multiple bolts, it's common to use a sequential tightening pattern. This involves tightening the bolts in a specific order (often in a cross or star pattern) to distribute the load evenly and prevent misalignment or leaks.
6. **Tensioning:** In some high-pressure applications, hydraulic tensioning tools may be used to achieve accurate and uniform bolt tension. This method ensures precise bolt elongation and load distribution.
7. **Record Keeping:** Detailed records of fastener installation, including torque values, bolt sizes, and inspection results, should be maintained for quality control and future reference.
8. **Inspection and Testing:** After fastener installation, pipelines are often subjected to pressure testing to ensure the integrity of the connections. Leak testing methods, such as pressure decay tests or dye penetrant inspections, may also be used to verify the seal.
9. **Stress Analysis:** In critical applications, engineers may perform stress analysis to determine the proper torque or tension required for each fastener, taking into account factors like pipeline materials, temperature, and pressure.
10. **Training and Certification:** Proper training of personnel involved in fastener installation is crucial. Many industries have certification programs for bolt and fastener technicians to ensure they have the necessary knowledge and skills.
11. **Re-Tightening and Maintenance:** Fasteners may need periodic inspection and re-tightening to account for factors like thermal cycling and settling. Scheduled maintenance should be part of the pipeline's integrity management program.
12. **Material Selection:** Selecting the appropriate materials for fasteners, such as corrosion-resistant alloys, is essential to ensure long-term reliability.
13. **Environmental Considerations:** Environmental conditions, such as extreme temperatures or corrosive atmospheres, should be considered when selecting fasteners and applying protective coatings.

It's important to note that specific procedures can vary depending on the type of fastener, pipeline material, and industry standards or regulations. Therefore, pipeline operators and engineers must adhere to relevant codes and standards and follow manufacturer recommendations to secure fasteners effectively and safely in their specific applications.

How are fasteners used and what are the procedures in oil substations, natural gas substations, and water substations?

Fasteners play a crucial role in the construction and maintenance of substations in the oil, natural gas, and water industries. These substations are essential for processing, distribution, and control of the respective resources. The usage and procedures for fasteners in each type of substation can vary, but there are commonalities:

Oil Substations:

1. **Transformer Mounting:** Fasteners are used to secure transformers to their foundations or platforms. Proper torque and load distribution are critical to ensure the stability of these heavy components.
2. **Busbar Connections:** Busbars carry electrical current within the substation. Bolts and nuts secure busbar connections to ensure electrical continuity and minimize resistance.
3. **Cable Tray Installation:** Cable trays are used to support and route electrical cables. Fasteners are used to secure cable trays to support structures or walls.
4. **Switchgear Assembly:** Fasteners are employed in assembling switchgear components such as circuit breakers, disconnect switches, and relays. Proper tightening and torque control are crucial for electrical safety.
5. **Grounding Connections:** Grounding systems in substations use fasteners to ensure a reliable electrical ground. Proper installation prevents electrical faults and enhances safety.
6. **Lightning Protection:** Lightning protection systems often use fasteners to secure lightning rods and conductors. These systems are critical for protecting substation equipment from lightning strikes.

Natural Gas Substations:

1. **Pipeline Connections:** Fasteners are used to connect and secure various components of natural gas pipelines, including valves, regulators, and metering equipment. Proper torque and sealing are essential to prevent leaks.
2. **Compressor and Pump Installations:** In compressor and pump stations, fasteners secure equipment to their foundations. This is important to prevent vibration-related issues and ensure operational reliability.
3. **Flange Connections:** Flanges and fasteners are used to connect pipeline segments, ensuring a leak-tight connection. Tightening procedures follow industry standards to achieve proper sealing.
4. **Pressure Relief Valve Installation:** Fasteners secure pressure relief valves to prevent overpressure incidents. Proper installation ensures the valves function as designed.
5. **Instrumentation and Control Panels:** Fasteners are used to assemble control panels and instrumentation, which are crucial for monitoring and controlling gas flow and safety systems.

Water Substations (Water Treatment and Distribution):

1. **Pump and Motor Mounting:** Fasteners secure pumps, motors, and associated equipment to their bases or pedestals. Proper alignment and torque are essential to prevent mechanical issues.
2. **Pipe Connections:** Fasteners, such as bolts and nuts, are used to connect pipes and fittings in water treatment and distribution systems. Proper sealing is crucial to prevent leaks.
3. **Valve Assembly:** Fasteners secure valves to pipes and other components. Proper installation ensures reliable flow control and leak prevention.
4. **Filter and Clarifier Installation:** Fasteners are used to assemble and secure filtration and clarification equipment. Proper tightening is necessary to maintain water quality.
5. **Chemical Feed Systems:** Fasteners are used in the assembly of chemical feed systems for water treatment. Precise installation is essential for accurate chemical dosing.
6. **Instrumentation and Control Panels:** Fasteners secure instrumentation and control panels that monitor and control water treatment processes.

In all cases, proper torque, material selection, and adherence to industry standards and regulations are essential when using fasteners in substations. Additionally, routine maintenance and inspections should be carried out to ensure the integrity and reliability of the substation infrastructure.

How are fasteners used in compressor stations for the above applications?

Compressor stations play a critical role in various industries, including oil, natural gas, and water treatment. These stations are responsible for increasing the pressure of the respective fluids or gases for transportation or processing. Fasteners are essential components in compressor stations for various applications. Here's how fasteners are used in compressor stations for the mentioned industries:

Oil Compressor Stations:

1. **Compressor Mounting:** Fasteners are used to secure compressors to their foundations or skids. Proper torque and load distribution are crucial to ensure the stability and alignment of the compressor units.
2. **Piping and Flange Connections:** Compressor stations have extensive piping systems for the transport of oil and gas. Fasteners, such as bolts and nuts, are used to connect pipes, flanges, valves, and other components. Proper tightening procedures are essential to prevent leaks in these high-pressure systems.
3. **Instrumentation and Control Panels:** Fasteners are used to assemble and secure control panels, instrumentation, and electrical components. These components monitor and control the compressor's operation, ensuring efficiency and safety.
4. **Vibration Isolation:** Compressors generate significant vibrations during operation. Fasteners are used to secure vibration isolation mounts and dampers to minimize the transmission of vibrations to the station's structure.
5. **Cooling and Heat Exchange Systems:** Fasteners are used to install and secure cooling fans, heat exchangers, and associated equipment to regulate the temperature of the compressors and maintain their efficiency.

Natural Gas Compressor Stations:

1. **Compressor Unit Mounting:** Fasteners are used to anchor gas compressors to their foundations or skids. Proper installation is crucial to ensure the stability of these heavy machines.
2. **Piping and Flange Connections:** Similar to oil compressor stations, natural gas compressor stations rely on fasteners to connect and secure various components in the pipeline system, including pipes, valves, and flanges.
3. **Scrubbers and Separators:** Fasteners are used to assemble and secure scrubbers and separators, which remove impurities and moisture from the natural gas stream before compression.
4. **Emission Control Equipment:** Fasteners are used to install emission control devices and equipment required to meet environmental regulations.
5. **Noise Reduction Equipment:** Compressor stations often use noise reduction equipment like acoustic enclosures. Fasteners secure these enclosures to reduce noise emissions.

Water Treatment Compressor Stations:

1. **Aeration Systems:** In water treatment compressor stations, fasteners secure aeration equipment, such as diffusers and blowers, which provide oxygen to support biological treatment processes.
2. **Blower Mounting:** Fasteners are used to mount and secure blowers or compressors that provide air for wastewater treatment processes.
3. **Piping and Ductwork:** Fasteners are essential for connecting pipes, ducts, and associated components in the air and gas distribution systems used for water treatment processes.
4. **Instrumentation and Control Panels:** Fasteners secure instrumentation and control panels that monitor and regulate the various processes within the water treatment compressor station.

In all these applications, selecting the right fasteners, adhering to manufacturer specifications, and following industry standards for torque and tightening procedures are crucial for ensuring the reliability and safety of compressor station operations. Regular maintenance and inspections are also essential to identify and address any fastener-related issues that may arise over time.

What are the maintenance issues to consider when using fasteners in all the above applications and procedures?

Maintenance issues related to fasteners in various applications, including those mentioned in the previous responses, are critical to ensuring the safety, integrity, and reliability of industrial systems. Here are some common maintenance issues to consider:

1. Corrosion:

- **Prevention:** Fasteners can corrode over time, especially in harsh environments like those found in oil, gas, and water facilities. Regular inspection and the use of corrosion-resistant materials, coatings, or inhibitors can help prevent corrosion.

2. Loose Fasteners:

- **Tightening:** Bolts and nuts can gradually become loose due to vibration or thermal cycling. Regular torque checks and re-tightening are necessary to maintain the integrity of connections.

3. Fatigue Failure:

- **Stress Analysis:** In high-stress applications, fasteners can experience fatigue failure over time. Stress analysis and periodic inspections can identify potential issues before catastrophic failure occurs.

4. Material Degradation:

- **Material Compatibility:** Ensure that fastener materials are compatible with the substances they come into contact with. For instance, in water treatment, consider the effects of chemical exposure on fastener materials.

5. Gasket and Seal Degradation:

- **Inspection:** In flange connections, gaskets and seals can degrade, leading to leaks. Regular inspection and replacement of gaskets and seals are essential for leak prevention.

6. Environmental Factors:

- **Exposure:** Fasteners exposed to extreme temperatures, humidity, or corrosive substances can deteriorate more rapidly. Protective coatings and enclosures may be needed.

7. Vibration and Shock:

- **Vibration Analysis:** Vibrations and shocks from equipment operation can lead to fastener loosening. Monitoring equipment for signs of excessive vibration and securing fasteners appropriately is crucial.

8. Over-Tightening:

- **Torque Control:** Over-tightening fasteners can cause damage to components and lead to stress-related failures. Proper torque control during installation and maintenance is essential.

9. Under-Tightening:

- **Torque Control:** Under-tightened fasteners can result in loose connections and leaks. Regular torque checks and re-tightening can address this issue.

10. Insufficient Lubrication:
Lubrication: Inadequate lubrication of threads can make it difficult to achieve the required torque during installation. Regularly apply the recommended lubricants to ensure proper tightening.

11. Inadequate Record Keeping:
Documentation: Maintaining detailed records of fastener installation, torque values, inspection results, and maintenance activities is crucial for tracking the condition of fasteners over time.

12. Aging Infrastructure:
Replacement: In older facilities, fasteners and other components may have reached the end of their service life. Planning for periodic replacements and upgrades is essential to prevent failures.

13. Environmental Regulations:
Compliance: Compliance with environmental regulations is crucial. For example, in the oil and gas industry, ensuring that fasteners and seals meet regulatory standards for preventing leaks is essential to avoid environmental incidents.

14. Safety Considerations:
Safety Checks: Loose or damaged fasteners can pose safety hazards. Regular safety checks and maintenance procedures are vital to prevent accidents.

It's important for maintenance teams to follow manufacturer recommendations, industry standards, and regulations specific to the application and environment. Additionally, implementing a proactive maintenance program that includes routine inspections, torque checks, and fastener replacement as needed can help mitigate many of these maintenance issues and extend the life of fasteners in critical systems.

What are the safety considerations when using fasteners in all the above applications and procedures?

Safety considerations when using fasteners in various applications and procedures are crucial to prevent accidents, injuries, and equipment failures. Here are some important safety considerations to keep in mind:

1. Personal Protective Equipment (PPE):

- Ensure that personnel involved in fastener installation and maintenance wear appropriate PPE, including gloves, safety glasses, and hearing protection, depending on the specific tasks and environmental hazards.

2. Torque Control:

- Use calibrated torque tools and follow recommended torque values to prevent over-tightening or under-tightening of fasteners. Proper torque control is essential for the integrity of connections and safety.

3. Material Compatibility:

- Confirm that fastener materials are compatible with the substances they come into contact with. In cases where chemical compatibility is a concern, select appropriate materials to prevent corrosion and degradation.

4. Vibration and Shock:

- Address vibration and shock-related issues by using vibration-damping materials, isolating equipment, or employing locking mechanisms to prevent fastener loosening in high-vibration environments.

5. Fall Protection:

- When working at heights or on elevated structures, ensure that workers have proper fall protection equipment, such as harnesses and safety lanyards, to prevent falls.

6. Electrical Safety:

- In electrical applications, ensure that fasteners are correctly used in electrical grounding systems to maintain electrical safety and prevent electrical faults.

7. Hazardous Materials:

- When dealing with hazardous substances like oil, gas, or chemicals, follow safety protocols, including proper handling, containment, and disposal of these materials.

8. Flammable Environments:

- In environments where flammable gases or liquids are present, take precautions to prevent sparks or ignition sources that could lead to fires or explosions during fastener installation and maintenance.

9. Lockout/Tagout (LOTO):

- Implement LOTO procedures to isolate and de-energize equipment before performing maintenance that involves fasteners. This helps prevent accidental startup and associated injuries.

10. Confined Spaces: - When working in confined spaces, follow confined space entry procedures and ensure proper ventilation, lighting, and safety equipment are in place. Confined spaces may require specialized training and permits.

11. Lifting and Rigging: - When lifting heavy equipment or components secured by fasteners, use appropriate lifting and rigging equipment, such as slings, hoists, and cranes, and ensure load capacity is not exceeded.

12. Inspections and Maintenance: - Conduct regular inspections of fasteners and associated components to identify wear, damage, or degradation. Address issues promptly to prevent failures that could lead to accidents.

13. Documentation: - Maintain detailed records of fastener installation, inspection, and maintenance activities. Accurate documentation can aid in tracking the condition of fasteners and ensuring safety compliance.

14. Training and Competency: - Ensure that personnel involved in fastener-related tasks are adequately trained and competent in their roles, including knowledge of safety procedures and industry standards.

15. Environmental Protection: - Adhere to environmental regulations and best practices to prevent leaks and spills that can harm the environment. Proper sealing and maintenance of fasteners are essential in this regard.

16. Emergency Response: - Establish and communicate emergency response procedures in case of fastener-related accidents or failures. Ensure that personnel know how to respond to different scenarios to minimize risks.

Safety should always be a top priority when working with fasteners in various applications. It's essential to create a culture of safety, provide training and resources, and regularly review and update safety protocols to address specific risks associated with each application and environment.

FRESHWATER TREATMENT PLANT FASTENERS

Running a freshwater treatment plant requires a combination of various equipment and processes to effectively treat and purify water for safe consumption. The specific composition of equipment can vary based on the scale of the plant, the water source, and the treatment processes used. Here is a general overview of the equipment commonly found in a freshwater treatment plant:

1. **Intake Structures:**
   - Screens: Removes large debris from the water.
   - Grates and Bar Screens: Collects larger objects and prevents them from entering the treatment process.
2. **Coagulation and Flocculation:**
   - Coagulant Dosing System: Adds chemicals (e.g., alum, ferric chloride) to destabilize particles in the water.
   - Rapid Mixers: Facilitates the mixing of coagulants, aiding in particle aggregation.
   - Flocculators: Gently mix the water to encourage the formation of larger floc particles.
3. **Sedimentation:**
   - Clarifiers/Settling Tanks: Allows the floc particles to settle out from the water.
   - Sludge Removal System: Removes settled particles (sludge) from the bottom of the tanks.
4. **Filtration:**
   - Rapid Sand Filters: Removes finer particles that may have escaped sedimentation.
   - Filter Media: Layers of sand and gravel that capture impurities as water passes through.
5. **Disinfection:**
   - Disinfectant Dosing System: Adds chemicals like chlorine, chloramine, or ozone to kill harmful microorganisms.

- Contact Chambers: Allows time for disinfection to take effect.
- UV Disinfection Units: Exposes water to ultraviolet light to destroy pathogens.

6. **pH Adjustment:**
    - Chemical Dosing Systems: Adds chemicals to adjust and stabilize the pH of the treated water.
7. **Storage and Distribution:**
    - Clear Water Reservoirs: Stores treated water before distribution.
    - Pumping Stations: Distributes water to consumers through a network of pipes.
8. **Monitoring and Control:**
    - Sensors and Analyzers: Measure parameters like turbidity, pH, chlorine levels, etc.
    - Supervisory Control and Data Acquisition (SCADA) System: Monitors and controls the plant's processes remotely.
9. **Waste Management:**
    - Sludge Handling Equipment: Processes and manages sludge generated during treatment.
    - Residuals Management Systems: Deals with the disposal of chemical residuals and byproducts.
10. **Backup Systems:**
    - Emergency Generators: Ensure continuous operation during power outages.
11. **Chemical Storage and Handling:**
    - Storage Tanks and Handling Equipment: Store and manage chemicals used in the treatment process.
12. **Laboratory Facilities:**
    - Quality Control Lab: Conducts regular testing of water samples to ensure compliance with safety standards.

Keep in mind that the specific equipment and processes can vary based on the treatment technologies used, regulatory requirements, and the unique characteristics of the water source being treated. The design and operation of a freshwater treatment plant require careful consideration of these factors to ensure the production of safe and clean drinking water.

From the overview of the equipment commonly found in a freshwater treatment plant, what type and size of fasteners are needed for the equipment?

The type and size of fasteners needed for equipment in a freshwater treatment plant can vary widely based on factors such as the equipment's size, material, weight, function, and the specific requirements of the installation. Here are some general guidelines for the types of fasteners commonly used in such environments:

1. **Bolts and Nuts:**
    - Stainless steel bolts and nuts are often preferred due to their corrosion resistance.
    - The size and length of bolts depend on the thickness of materials being fastened and the load they need to bear.
2. **Screws:**
    - Stainless steel screws are suitable for attaching smaller components, panels, and fixtures.
    - Self-tapping screws might be needed to secure components to metal surfaces.
3. **Anchors:**
    - Anchors are used to secure equipment to concrete or masonry surfaces.
    - Expansion anchors, sleeve anchors, or chemical anchors might be required depending on load requirements.
4. **Washers:**
    - Stainless steel washers can be used to distribute load and prevent damage to surfaces.
    - Flat washers, lock washers, and fender washers may be needed for different applications.

5. **Clamps and Brackets:**
    - Stainless steel clamps and brackets are used to secure pipes, conduits, and other equipment to support structures.
6. **Hangers:**
    - Pipe hangers, also made from stainless steel, are used to support and secure pipes along their length.
7. **Threaded Rods and Studs:**
    - Threaded rods and studs provide adjustable support and attachment points for equipment and structures.
8. **Straps and Ties:**
    - Metal straps and ties secure equipment and pipes together.
9. **Cable and Hose Clamps:**
    - Used to secure electrical cables, wires, and hoses in place.
10. **Fastening Systems for Concrete or Masonry:**
    - Expansion bolts, concrete screws, and chemical anchors are used for attaching equipment to concrete or masonry surfaces.
11. **Fastening Tools:**
    - Depending on the type of fasteners used, tools like wrenches, socket sets, screwdrivers, drills, and impact drivers will be necessary.

When selecting fasteners, it's important to consider factors such as the environment's potential for corrosion due to water and chemicals, load-bearing requirements, and any specific regulations or standards applicable to the treatment plant's construction. The sizes and types of fasteners needed will vary based on the specific equipment and installation requirements, so consulting with engineers, equipment manufacturers, or construction experts is recommended to ensure the correct choice of fasteners for each application.

What water pressures are found in a freshwater treatment plant and what fasteners are necessary to secure the equipment used?

The water pressures found in a freshwater treatment plant can vary widely depending on the specific processes and equipment being used. Different stages of the treatment process and various types of equipment may require different pressure levels. Here are some general guidelines for water pressures in different areas of a treatment plant:

1. **Intake and Screening:**
    - Water pressures in this area are typically low, often close to atmospheric pressure.
    - Fasteners used here need to secure screens, grates, and initial piping. Generally, standard stainless steel bolts, nuts, and washers would be appropriate.
2. **Coagulation and Flocculation:**
    - Moderate water pressures are common in this stage to ensure proper mixing of chemicals and water.
    - Fasteners for securing chemical dosing equipment and mixers might require stainless steel bolts and nuts.
3. **Sedimentation and Filtration:**
    - Water pressures can vary depending on the specific equipment used, such as clarifiers, settling tanks, and sand filters.
    - The type of fasteners required will depend on the equipment design and materials. Stainless steel bolts, nuts, and possibly expansion anchors might be used.
4. **Disinfection:**
    - Water pressures can vary, but this stage generally involves adding disinfectants at controlled pressures.
    - Fasteners for securing disinfection equipment (like chemical dosing systems and UV units) should be compatible with the equipment's materials and potential corrosion.
5. **Pumping and Distribution:**
    - Water pressures can range from low to high depending on the elevation, distance, and requirements of the distribution network.
    - Fasteners for securing pipes, pumps, valves, and other distribution components should be chosen based on the anticipated pressures and the materials being connected.
    -

6. **Storage Tanks:**
    - Water pressures can be relatively low in storage tanks, often gravity-fed.
    - Fasteners for access hatches, inspection panels, and any structural components should be chosen considering potential corrosion.

For fasteners in a freshwater treatment plant, stainless steel is a common choice due to its resistance to corrosion in water and chemical environments. However, the specific type and size of fasteners required will depend on factors like the load-bearing capacity, the materials being fastened, the pressure requirements, and the potential for corrosion.

It's important to consult with engineers, equipment manufacturers, and possibly corrosion specialists to determine the exact fasteners needed for each specific application in the treatment plant. Additionally, adhering to relevant industry standards and guidelines is crucial to ensuring the safety and longevity of the plant's infrastructure.

What safety considerations must be in place in a freshwater treatment plant involving the fasteners used?

Safety considerations are paramount in a freshwater treatment plant to ensure the well-being of personnel, the integrity of the facility, and the quality of the treated water. When it comes to the fasteners used in the plant, several safety considerations should be in place:

1. **Corrosion Resistance:** As freshwater treatment plants often deal with water and chemicals, fasteners should be corrosion-resistant. Stainless steel fasteners are commonly used due to their ability to withstand corrosion in such environments.
2. **Material Compatibility:** Ensure that the materials used for fasteners are compatible with the materials they are securing. For example, different metals in contact with each other might cause galvanic corrosion.

3. **Load Capacity:** Fasteners should be selected based on the load-bearing requirements of the equipment they secure. Properly sized and rated fasteners prevent failures due to overloading.
4. **Installation Integrity:** Fasteners should be installed according to manufacturer specifications and industry standards to maintain their integrity. Improperly installed fasteners can compromise equipment stability and safety.
5. **Vibration and Movement:** Equipment in a treatment plant can generate vibration and movement. Fasteners should be chosen and installed to withstand these forces and prevent loosening over time.
6. **Accessibility and Maintenance:** Fasteners securing equipment that requires maintenance or inspection should be easily accessible. Properly placed fasteners facilitate safe maintenance operations.
7. **Preventing Contamination:** In areas where water is treated for consumption, the fasteners used should not introduce contaminants or impurities that could compromise water quality.
8. **Electrical Isolation:** Fasteners should not create electrical pathways between dissimilar materials that could lead to corrosion or electrical hazards.
9. **Environmental Conditions:** Consider the specific environmental conditions of the plant, such as temperature variations, humidity, and exposure to chemicals. Fasteners should be selected to withstand these conditions.
10. **Safety Training:** Personnel responsible for installation, maintenance, and repairs should receive proper training in handling and working with fasteners, especially when working at heights or in confined spaces.
11. **Inspections and Maintenance:** Regular inspections of fasteners should be performed to identify signs of corrosion, wear, or loosening. Timely maintenance ensures fasteners remain secure.
12. **Emergency Situations:** Fasteners securing critical equipment, especially in emergency systems, should be of high quality and reliability to ensure equipment functionality during emergencies.
13. **Documentation:** Maintain accurate records of the types, sizes, and locations of fasteners used. This information is valuable for maintenance and replacements.

14. **Regulatory Compliance:** Ensure that the chosen fasteners meet relevant safety standards and regulations for the industry.
15. **Risk Assessment:** Conduct thorough risk assessments to identify potential hazards related to fasteners and implement appropriate controls to mitigate those risks.

Remember that safety considerations extend beyond the fasteners themselves to encompass the entire installation process, ongoing maintenance, and the overall design of the treatment plant. Collaborating with engineering experts, following industry best practices, and adhering to relevant safety guidelines are crucial for establishing a safe and reliable freshwater treatment plant.

What procedures should be used in doing maintenance in a freshwater treatment plant?

Maintenance procedures in a freshwater treatment plant are critical to ensuring the ongoing functionality, efficiency, and safety of the plant's equipment and processes. Proper maintenance helps prevent breakdowns, extends the lifespan of equipment, and maintains water quality. Here are the general steps and procedures to follow for maintenance in a freshwater treatment plant:

1. **Develop a Maintenance Plan:**
   - Create a comprehensive maintenance plan that outlines the frequency and types of maintenance tasks for each piece of equipment.
2. **Regular Inspections:**
   - Conduct routine inspections of all equipment, structures, and systems to identify potential issues before they become major problems.
3. **Documentation:**
   - Keep detailed records of maintenance activities, including dates, tasks performed, and any issues identified. This documentation helps track equipment performance and plan future maintenance.
4. **Scheduled Maintenance:**

- Perform scheduled maintenance tasks as outlined in the maintenance plan. This can include cleaning, lubricating, adjusting, and testing equipment.

5. **Predictive Maintenance:**
   - Use predictive techniques such as vibration analysis, thermal imaging, and oil analysis to identify potential failures before they occur.
6. **Corrective Maintenance:**
   - Address unexpected failures promptly to minimize downtime and prevent further damage. Have contingency plans in place for critical equipment.
7. **Safety Precautions:**
   - Ensure that maintenance personnel follow proper safety protocols, wear appropriate personal protective equipment (PPE), and are trained to work safely around equipment.
8. **Lockout/Tagout Procedures:**
   - Use lockout/tagout procedures to isolate equipment from energy sources before performing maintenance to prevent accidental startup.
9. **Cleaning:**
   - Regularly clean equipment and surfaces to prevent the buildup of debris, which can impede functionality and compromise water quality.
10. **Lubrication:**
    - Apply appropriate lubricants to moving parts to reduce friction and wear.
11. **Tightening and Fastening:**
    - Check and tighten fasteners as necessary to prevent loosening due to vibration and movement.
12. **Calibration:**
    - Calibrate sensors, meters, and instruments to ensure accurate measurements and reliable process control.
13. **Chemical Replacement:**
    - Replace chemicals used in the treatment process according to a predetermined schedule and guidelines.
14. **Equipment Testing:**

- Test equipment performance to verify that it operates within specified parameters. This includes checking pressures, flow rates, and chemical dosing rates.

15. **Training:**
    - Ensure maintenance personnel are trained and knowledgeable about the equipment they are responsible for maintaining.
16. **Emergency Procedures:**
    - Have clear procedures in place for responding to emergencies, including equipment failures or system malfunctions.
17. **Spare Parts Inventory:**
    - Maintain an inventory of critical spare parts to facilitate quick repairs and minimize downtime.
18. **Vendor Support:**
    - Establish relationships with equipment manufacturers and suppliers for technical support and replacement parts.
19. **Continuous Improvement:**
    - Regularly review and update maintenance procedures based on lessons learned, technological advancements, and changing operational needs.
20. **Environmental Considerations:**
    - Ensure that maintenance activities do not introduce contaminants into the water supply or damage the environment.

Remember that maintenance should be a proactive effort aimed at preventing issues rather than just addressing them when they arise. Following a well-structured maintenance plan, emphasizing safety, and utilizing modern maintenance techniques will help keep the freshwater treatment plant operating efficiently and effectively.

HYDRAULIC FRACTURING

Fracking, also known as hydraulic fracturing, is a method used in the oil and gas industry to extract natural gas and oil from underground rock formations. The process involves injecting a mixture of water, sand, and chemicals at high pressure into a wellbore (a drilled hole), which fractures the rock and releases the trapped oil or gas.

Here's a breakdown of the process:

1. **Well Drilling:** A wellbore is drilled vertically and then turned horizontally to access the oil or gas-bearing rock formation. The wellbore is lined with steel casing and cement to prevent the release of fluids and gases into surrounding formations.
2. **Injection:** A fluid mixture is pumped into the wellbore at high pressure. This mixture consists of water, proppants (usually sand or ceramic beads), and chemical additives. The water serves as the primary fluid, while the proppants keep the fractures open after they are created.
3. **Fracturing:** The high-pressure fluid causes the rock to crack, creating fractures in the rock formation. The proppants injected along with the fluid are carried into these fractures and hold them open, allowing the oil or gas to flow more easily.
4. **Flowback and Production:** After the fracturing process, the pressure is reduced, and some of the injected fluid, along with the naturally occurring fluids from the rock formation, flows back to the surface. This mixture is called "flowback." Once the flowback diminishes, oil or gas production begins through the well.

Fracking has significantly increased the production of oil and natural gas in many regions, making it a major contributor to global energy supplies. However, it has also been a subject of controversy due to its potential environmental impacts. Concerns include:

1. **Water Usage:** Fracking requires large amounts of water, which can strain local water supplies, especially in water-scarce regions.
2. **Chemical Use:** The chemicals added to the fracking fluid can potentially contaminate groundwater if they migrate from the wellbore.
3. **Methane Emissions:** Methane, a potent greenhouse gas, can escape during fracking operations, contributing to climate change.
4. **Induced Seismicity:** The injection of fluid into the rock can trigger earthquakes, albeit typically of low magnitude.
5. **Waste Disposal:** The disposal of flowback fluids, which can contain chemicals and other contaminants, requires proper management to avoid environmental harm.

Regulations and industry practices vary by region, and there have been ongoing debates and studies regarding the balance between the economic benefits of fracking and its potential environmental and health risks.

What tools are involved in hydraulic fracturing?

Hydraulic fracturing, or fracking, involves the use of various tools and equipment to carry out the process effectively and safely. Here are some of the key tools involved in hydraulic fracturing:

1. **Drilling Rig:** A drilling rig is used to create the wellbore that reaches the oil or gas-bearing rock formation. Modern drilling rigs are equipped with advanced technology to drill both vertically and horizontally.
2. **Casing and Cementing Equipment:** Steel casing and cement are used to line the wellbore, isolating it from surrounding formations and preventing the migration of fluids and gases. Cementing equipment is used to pump cement into the wellbore to secure the casing in place.
3. **Perforating Guns:** Perforating guns are used to create holes or perforations in the casing and cement, allowing the fracking fluid to access the rock formation. These perforations are usually made in the horizontal section of the wellbore.

4. **High-Pressure Pumps:** High-pressure pumps are used to inject the fracking fluid into the wellbore at extremely high pressures. These pumps create the pressure needed to fracture the rock formation.
5. **Blenders:** Blenders are used to mix the components of the fracking fluid, which typically include water, proppants (sand or ceramic beads), and chemical additives. The blenders ensure that the mixture is properly prepared before injection.
6. **Hydraulic Fracturing Units:** These units contain the high-pressure pumps and blenders. They are responsible for pressurizing and injecting the fracking fluid into the wellbore.
7. **Proppant Delivery System:** Proppants are solid materials (usually sand or ceramic beads) added to the fracking fluid to hold open the fractures created in the rock. A proppant delivery system transports and injects proppants into the fractures to keep them from closing after the pressure is reduced.
8. **Monitoring and Control Systems:** Hydraulic fracturing operations require sophisticated monitoring and control systems to ensure the process is carried out safely and efficiently. These systems track various parameters such as pressure, flow rate, and fluid composition.
9. **Flowback and Produced Fluid Handling Equipment:** After the fracking process, fluids from the well, including flowback (a mixture of injected fluids and natural formation fluids) and produced fluids (oil, gas, and water), need to be managed. Equipment for separating, treating, and storing these fluids is used.
10. **Environmental and Safety Equipment:** Safety is a paramount concern in hydraulic fracturing operations. Equipment such as blowout preventers, fire prevention systems, and emergency shut-off systems are used to mitigate risks.
11. **Data Collection and Analysis Tools:** Modern fracking operations often involve data collection and analysis tools to optimize the process. This can include real-time monitoring of pressure, temperature, and other parameters downhole and at the surface.

These are some of the primary tools involved in hydraulic fracturing. The specific tools used can vary depending on the location, well characteristics, and technological advancements available at the time of the operation.

What tools are required to secure the fasteners in hydraulic fracturing?

Securing fasteners in hydraulic fracturing operations requires a range of tools to ensure that connections are properly tightened and maintained. Fasteners are used to assemble and secure various components of the hydraulic fracturing equipment, such as pumps, valves, and pipelines. Here are some of the tools commonly used to secure fasteners in hydraulic fracturing:

1. **Wrenches:** Wrenches come in various types, including open-end wrenches, box-end wrenches, and adjustable wrenches. They are used to grip and turn nuts and bolts to tighten or loosen fasteners.
2. **Socket Sets:** Socket sets consist of various sizes of sockets that fit onto ratchets or torque wrenches. These tools are used for fasteners with hexagonal or square heads, providing a more secure grip and better torque application.
3. **Torque Wrenches:** Torque wrenches are critical for ensuring that fasteners are tightened to the appropriate torque specification. These wrenches measure the amount of torque applied, helping prevent over-tightening or under-tightening.
4. **Impact Wrenches:** Impact wrenches are powered tools that use impact force to tighten or loosen fasteners quickly. They are particularly useful for large or heavy-duty fasteners.
5. **Hydraulic Torque Wrenches:** Hydraulic torque wrenches are specialized tools that use hydraulic pressure to apply precise torque to fasteners. They are commonly used in industries like oil and gas due to their accuracy and efficiency.
6. **Bolt Tensioners:** Bolt tensioners are tools designed to stretch fasteners to a specific tension rather than relying solely on torque. They are particularly

useful for applications where accurate and consistent bolt preload is essential.

7. **Thread Locking Compounds:** Thread locking compounds are adhesives applied to fasteners before tightening. They help prevent loosening due to vibration or other external factors.
8. **Fastener Lubricants:** Lubricants reduce friction during the tightening process, which can result in more accurate torque application and less wear on fasteners.
9. **Calibrated Torque Wrench Testers:** These testers are used to verify the accuracy of torque wrenches and ensure they are applying the correct amount of torque.
10. **Safety Tools:** Safety wire pliers and clips are used to secure nuts and bolts in applications where vibrations or other external forces might cause fasteners to loosen. These tools are essential for maintaining the integrity of critical connections.
11. **Measuring Tools:** Tools such as rulers, tape measures, and calipers are used to ensure proper alignment and spacing when securing fasteners.

It's important to note that proper training and expertise are crucial when using these tools to secure fasteners in hydraulic fracturing operations. Over-tightening or under-tightening fasteners can lead to equipment failure, leaks, and safety hazards. Therefore, experienced professionals should be responsible for using these tools correctly and following recommended torque specifications and procedures.

What are the safety factors to consider in hydraulic fracturing and the safety involving securing the fasteners used?

Hydraulic fracturing (fracking) operations involve various safety considerations due to the high pressures, complex equipment, and potential for environmental and human impacts. Additionally, ensuring the safety of fastener connections is crucial to prevent equipment failures that could lead to accidents or leaks. Here are some safety factors to consider in hydraulic fracturing and when securing fasteners:

Hydraulic Fracturing Safety Considerations:

1. **Well Integrity:** Ensuring the integrity of well casings and cement is vital to prevent leaks of fluids, including fracking fluids and hydrocarbons, into surrounding formations or groundwater.
2. **High Pressure Management:** Hydraulic fracturing involves extremely high pressures that must be carefully controlled and monitored to prevent equipment failures and blowouts.
3. **Chemical Handling:** Proper handling, storage, and transport of chemicals used in fracking fluids are essential to minimize the risk of spills, leaks, or worker exposure.
4. **Water Management:** Managing water resources efficiently to avoid overuse and contamination is critical, as hydraulic fracturing requires significant amounts of water.
5. **Air Quality:** Preventing the release of volatile organic compounds (VOCs) and other pollutants from fracking operations is important to protect air quality and minimize health risks.
6. **Methane Emissions:** Controlling methane emissions during the entire fracking process helps reduce the environmental impact and address concerns related to greenhouse gas emissions.
7. **Seismic Activity:** Monitoring and managing induced seismic activity resulting from fracking operations can help prevent earthquakes of significant magnitude.
8. **Waste Disposal:** Proper handling and disposal of waste materials, including flowback fluids and solid waste, are crucial to prevent environmental contamination.
9. **Emergency Response:** Having well-defined emergency response plans in place for various scenarios, such as equipment failures, leaks, fires, and spills, is essential to mitigate potential risks.

Securing Fasteners Safety Considerations:

1. **Proper Tools and Techniques:** Using the appropriate tools and techniques for securing fasteners helps prevent under-tightening or over-tightening, which can lead to equipment failures.
2. **Torque Specifications:** Following recommended torque specifications for each fastener ensures that connections are properly tightened to the correct level.
3. **Calibration:** Regularly calibrating torque wrenches and other tools used to secure fasteners helps maintain accuracy and reliability.
4. **Visual Inspection:** Conducting visual inspections of fasteners after installation to ensure they are properly seated and show no signs of damage or misalignment.
5. **Thread Integrity:** Ensuring the integrity of threaded connections is crucial to prevent leaks or structural failures. Inspect threads for wear, damage, or signs of corrosion.
6. **Locking Mechanisms:** Using locking compounds, washers, or other locking mechanisms can prevent fasteners from loosening due to vibration or thermal cycling.
7. **Tightening Sequence:** Following a proper tightening sequence for multi-bolt connections helps distribute loads evenly and ensures uniform stress distribution.
8. **Quality Control:** Implementing quality control measures during equipment assembly and maintenance helps catch potential issues before they lead to failures.
9. **Training and Competency:** Providing training to personnel responsible for securing fasteners ensures they have the knowledge and skills to perform the tasks safely and effectively.

Both hydraulic fracturing operations and the securing of fasteners require a comprehensive approach to safety. Rigorous adherence to industry best practices, regulatory guidelines, and established safety protocols is essential to prevent accidents, protect workers, and minimize environmental impacts.

How are mud pumps used in hydraulic fracturing?

Mud pumps play a critical role in hydraulic fracturing (fracking) operations by providing the high-pressure power needed to inject fracking fluids into the wellbore. While the term "mud pump" may suggest a connection to drilling mud, in hydraulic fracturing, these pumps are used to transport and inject the fracturing fluid mixture into the well to create fractures in the rock formation. Here's how mud pumps are used in hydraulic fracturing:

1. **Injection of Fracking Fluids:** Fracking operations require the injection of a fluid mixture under high pressure into the wellbore. This fluid mixture, known as fracking fluid, typically consists of water, proppants (usually sand or ceramic beads), and chemical additives. The high-pressure injection causes the rock formation to fracture, creating pathways for oil and gas to flow more freely.
2. **Mud Pump Components:** A mud pump is a heavy-duty, reciprocating pump designed to handle the high pressures required for hydraulic fracturing. It consists of key components, including the power end and fluid end.
   - **Power End:** The power end of the mud pump contains the motor or engine that provides the power to drive the pump's reciprocating motion.
   - **Fluid End:** The fluid end houses the pistons, cylinders, and valves responsible for pumping the fracturing fluid. It contains the components that handle the high-pressure fluid and create the pumping action.
3. **Reciprocating Action:** Mud pumps use a reciprocating or piston-like action to create high-pressure fluid flow. As the piston moves back and forth in the cylinder, it alternately draws in and discharges the fracturing fluid. This reciprocating action allows the pump to generate the required high pressure for injection.
4. **High Pressure Generation:** Mud pumps are designed to generate very high pressures, often exceeding 10,000 psi (pounds per square inch) or more. This

high pressure is necessary to overcome the resistance of the rock formation and create fractures.

5. **Connecting to the Wellbore:** The fluid end of the mud pump is connected to the wellhead or wellhead equipment via high-pressure hoses. The fracking fluid is pumped through these hoses and into the wellbore.
6. **Monitoring and Control:** Mud pumps are equipped with monitoring and control systems to ensure that the pressure, flow rate, and other parameters are within the desired range. These systems help maintain the integrity of the hydraulic fracturing process and prevent equipment failures.
7. **Safety Measures:** Mud pumps are operated and maintained by trained personnel to ensure safety. Adequate safety measures, such as pressure relief valves and emergency shutdown systems, are in place to prevent over-pressurization and other potential hazards.
8. **Flowback and Cleanup:** After the fracturing process is complete, the mud pumps may be used for flowback operations to recover the injected fluids and other materials that return to the surface. The same mud pumps or separate equipment may be used for this purpose.

Overall, mud pumps are essential components of hydraulic fracturing operations, providing the necessary pressure to inject fracking fluids into the wellbore and create fractures in the rock formation, thereby facilitating the extraction of oil and gas resources.

What maintenance is required on the mud pumps used in hydraulic fracturing and what is the maintenance procedure?

Maintenance of mud pumps used in hydraulic fracturing is crucial to ensure their reliable performance, extend their lifespan, and prevent costly downtime. Proper maintenance procedures help identify and address potential issues before they lead to equipment failures. Here are the key maintenance steps and procedures for mud pumps used in hydraulic fracturing:

1. **Regular Inspections:**

- Conduct daily visual inspections to check for leaks, signs of wear, and any unusual noises.
- Inspect the power end and fluid end components for damage, corrosion, or loose connections.
- Check all fluid lines, hoses, and connections for signs of wear, deterioration, or leaks.
- Monitor gauges and meters for accurate readings.

2. **Lubrication:**
   - Follow the manufacturer's recommendations for lubricating various components of the pump, including bearings, pistons, and valves.
   - Use the appropriate lubricants specified for each component.
3. **Fluid End Maintenance:**
   - Regularly inspect pistons, valves, and liners for signs of wear, corrosion, or damage.
   - Replace worn or damaged components as needed to maintain proper sealing and pressure generation.
   - Maintain proper valve clearances and seating to ensure efficient fluid flow.
4. **Power End Maintenance:**
   - Check power end components such as belts, pulleys, and couplings for proper alignment and tension.
   - Inspect the motor or engine for signs of wear, overheating, or oil leaks.
5. **Pressure Relief Valves:**
   - Ensure that pressure relief valves are functioning properly and set to the correct pressure limits.
   - Test pressure relief valves periodically to verify their operation.
6. **Seals and Packing:**
   - Inspect seals, packing, and gaskets for leaks and wear.
   - Replace damaged or worn seals to prevent fluid leaks and maintain pressure integrity.
7. **Filters and Strainers:**
   - Clean or replace filters and strainers regularly to prevent debris from entering the pump system.
   - Ensure that filters are properly sized and specified for the application.

8. **Bolts and Fasteners:**
    - Check and tighten bolts, nuts, and fasteners to the manufacturer's recommended torque values.
    - Regularly inspect for signs of loosening or corrosion.
9. **Vibration Analysis:**
    - Conduct vibration analysis to detect potential issues with bearings, alignment, and other components.
    - Address any abnormal vibration patterns promptly to prevent premature failures.
10. **Alignment:**
    - Ensure proper alignment between the power end and fluid end to minimize wear and vibration.
11. **Maintenance Records:**
    - Keep detailed maintenance records, including inspection dates, repairs, replacements, and any deviations from normal operating conditions.
12. **Manufacturer's Guidelines:**
    - Follow the manufacturer's recommended maintenance schedule and procedures outlined in the pump's manual.
13. **Training and Expertise:**
    - Ensure that maintenance personnel are properly trained to perform maintenance tasks and follow safety protocols.

It's important to note that maintenance procedures can vary based on the specific design and model of the mud pump, as well as the conditions of the hydraulic fracturing operation. Regular preventive maintenance can help identify issues before they lead to downtime and ensure that the mud pumps operate safely and efficiently throughout their service life.

What are the safety considerations when doing maintenance on mud pumps used in hydraulic fracturing?

Maintenance on mud pumps used in hydraulic fracturing involves potential hazards, so proper safety considerations and practices are essential to protect personnel, equipment, and the environment. Here are some important safety considerations to keep in mind when performing maintenance on mud pumps:

1. **Lockout-Tagout (LOTO):**
   - Before starting any maintenance work, follow proper lockout-tagout procedures to ensure that the pump is de-energized and cannot be accidentally operated.
2. **Personal Protective Equipment (PPE):**
   - Wear appropriate PPE, such as safety glasses, gloves, hearing protection, and appropriate clothing, to safeguard against potential hazards.
3. **Training and Competency:**
   - Only qualified and trained personnel should perform maintenance tasks on mud pumps.
   - Ensure that maintenance personnel are familiar with the specific pump's design, operating principles, and potential hazards.
4. **Ventilation:**
   - Perform maintenance in well-ventilated areas to prevent exposure to fumes or vapors that might be present in hydraulic fracturing environments.
5. **Chemical Handling:**
   - If maintenance involves handling chemicals or fluids, follow proper chemical handling procedures and use appropriate personal protective equipment.
6. **Pressure Release:**
   - Before working on any components of the pump, release pressure from the system and ensure that the pump is fully depressurized.
7. **Hydraulic Hazards:**
   - Be cautious of hydraulic systems that could move unexpectedly during maintenance. Ensure that hydraulic lines are properly locked out and secured.
8. **Hot Surfaces:**

- Mud pumps can generate heat during operation. Allow time for the pump to cool down before conducting maintenance on hot surfaces.

9. **Pinch Points and Moving Parts:**
   - Be aware of pinch points and moving parts during maintenance activities to avoid getting clothing, tools, or body parts caught in the machinery.
10. **Electrical Safety:**
    - If electrical components are involved, follow proper electrical safety protocols and ensure that power sources are properly isolated before maintenance begins.
11. **Fall Prevention:**
    - If working at heights, use appropriate fall protection equipment and follow safe work practices to prevent falls.
12. **Machine Guarding:**
    - Ensure that all machine guards and safety shields are in place before performing maintenance to prevent contact with moving parts.
13. **Fire Prevention:**
    - Avoid open flames or sparks in areas where flammable materials or fluids are present.
14. **Emergency Procedures:**
    - Know the location of emergency shutdown switches and procedures in case of unexpected events.
15. **Communication:**
    - Maintain clear communication with other team members, especially if working in a team environment. Use proper signaling and communication protocols.
16. **Proper Tools and Equipment:**
    - Use the correct tools and equipment for the maintenance tasks to avoid potential accidents or damage.
17. **Mud Pump Manuals:**
    - Refer to the mud pump manufacturer's manuals for specific safety instructions and maintenance procedures.

Prioritize safety at all times during mud pump maintenance activities. Following established safety protocols, using appropriate PPE, and being aware of potential hazards are crucial for preventing accidents and ensuring the well-being of personnel involved in hydraulic fracturing operations.

What tools are required when doing the maintenance on the fluid ends of the mud pumps used in hydraulic fracturing?

Maintenance on the fluid ends of mud pumps used in hydraulic fracturing requires a set of specific tools to properly inspect, repair, and maintain the components responsible for pumping the fracturing fluid. Here are some tools that may be required when performing maintenance on the fluid ends of mud pumps:

1. **Wrenches and Sockets:**
    - Open-end wrenches and sockets of various sizes are essential for loosening and tightening nuts, bolts, and fasteners.
2. **Torque Wrenches:**
    - Torque wrenches are used to ensure that fasteners are tightened to the correct torque specifications. Proper torque is crucial for maintaining seal integrity and preventing leaks.
3. **Allen Keys (Hex Keys):**
    - Allen keys are used for accessing and securing bolts with hexagonal heads, which are common in fluid end components.
4. **Pliers:**
    - Pliers may be used for gripping and turning components, such as valves and fittings, during maintenance.
5. **Gaskets and Seals:**
    - Tools for removing and installing gaskets and seals, such as seal pullers and seal installation tools, are necessary to ensure proper sealing.
6. **Valve Tools:**
    - Specialized tools for removing, inspecting, and replacing valves are essential for maintaining proper fluid flow and pressure control.

7. **Piston Pullers:**
    - Piston pullers are used to safely remove pistons from their cylinders for inspection or replacement.
8. **Lubrication Equipment:**
    - Grease guns or other lubrication equipment are needed to apply lubricants to moving parts and seals.
9. **Thread Cleaning Tools:**
    - Brushes or thread cleaning tools are used to clean threads on fasteners and components before reassembly.
10. **Cleaning Supplies:**
    - Cleaning solvents, rags, and brushes are used to clean components and surfaces before inspection and reassembly.
11. **Measuring Instruments:**
    - Calipers or micrometers may be needed to measure components such as liners and pistons for wear and dimensional accuracy.
12. **Gauge and Pressure Test Equipment:**
    - Pressure gauges and testing equipment are used to verify that pressure relief valves and pressure settings are within the correct range.
13. **Inspection Tools:**
    - Inspection mirrors, borescopes, and magnifying glasses may be used to visually inspect hard-to-reach areas.
14. **Fastener Organizers:**
    - Organizers such as magnetic trays or bins are useful for keeping track of fasteners during disassembly and reassembly.
15. **Safety Equipment:**
    - Personal protective equipment (PPE) such as safety glasses, gloves, and hearing protection should be worn to ensure safety during maintenance tasks.
16. **Manufacturer's Manuals and Documentation:**
    - Refer to the mud pump manufacturer's manuals and documentation for specific guidance on maintenance procedures and recommended tools.

It's important to note that the specific tools required for fluid end maintenance can vary depending on the design and model of the mud pump. Before performing maintenance, familiarize yourself with the pump's components, refer to manufacturer documentation, and ensure you have the necessary tools to complete the tasks safely and effectively.

INDUSTRIAL FASTENERS IN THE HEAVY EQUIPMENT AND MINING INDUSTRIES

Industrial fasteners play a critical role in the heavy equipment industry, including machinery used in mining, such as bulldozers, road graders, earth movers, dump trucks, and more. These fasteners are essential components that hold together various parts and components of heavy equipment, ensuring their structural integrity, safety, and reliability. Here's how industrial fasteners are important in these industries:

1. **Structural Integrity:** Heavy equipment is subjected to extreme loads, vibrations, and stress during operation. Industrial fasteners, such as bolts, nuts, screws, and rivets, are used to secure critical components like chassis frames, engine mounts, and hydraulic systems. They ensure that the equipment can withstand the harsh conditions of mining and heavy-duty construction work.
2. **Safety:** The safety of operators and workers in the mining and construction industries is paramount. Properly fastened components are crucial to prevent accidents, equipment failures, and potential hazards. Loose or improperly fastened parts can lead to catastrophic failures, posing risks to both personnel and expensive machinery.
3. **Durability:** Heavy equipment is exposed to various environmental elements, including extreme temperatures, moisture, dust, and abrasive materials in mining operations. High-quality fasteners made from corrosion-resistant materials ensure the longevity and reliability of the equipment by preventing rust and degradation.
4. **Maintenance and Repair:** Heavy equipment requires routine maintenance and occasional repairs. Industrial fasteners make it easier to disassemble and reassemble equipment for servicing. Quick access to critical components, facilitated by well-designed fastening systems, reduces downtime and maintenance costs.
5. **Customization and Upgrades:** As technology advances, heavy equipment may need modifications or upgrades to meet changing requirements. Industrial fasteners allow for the attachment of new components, accessories, or attachments, enabling the customization and adaptation of equipment for specific tasks.

6. **Efficiency and Productivity:** Properly fastened components contribute to the overall efficiency and productivity of heavy equipment. Reliable fasteners ensure that machinery operates smoothly and consistently, reducing the risk of breakdowns and costly delays.
7. **Weight and Balance:** Fasteners also play a role in maintaining the weight distribution and balance of heavy equipment, which is crucial for stability and safe operation. Fasteners secure counterweights and attachments, ensuring that the equipment remains balanced during use.
8. **Environmental Considerations:** Mining and heavy equipment industries are increasingly focused on sustainability and reducing their environmental footprint. Fasteners are used in the construction of eco-friendly equipment designs, and the selection of appropriate fasteners can influence the recyclability of machinery components.

In summary, industrial fasteners are integral to the heavy equipment and mining industries as they contribute to the safety, durability, efficiency, and maintainability of heavy machinery. Proper selection, installation, and maintenance of fasteners are essential to ensure the reliable performance of equipment in these demanding sectors.

Can you relate the use of industrial fasteners in their use on the equipment used?

Certainly! Let's relate the use of industrial fasteners to specific equipment commonly used in the heavy equipment and mining industries:

1. **Bulldozers:**
    - Fasteners are used to secure the tracks or wheels to the chassis, ensuring stability and maneuverability.
    - They are also employed in attaching the blade, ripper, and other attachments to the bulldozer for various tasks.
2. **Road Graders:**
    - Fasteners are crucial for securing the blade assembly to the grader's frame, allowing for precise grading and leveling of road surfaces.
    - They also play a role in attaching stabilizers and wheels to the grader.
3. **Earth Movers (Excavators and Loaders):**

- These machines use fasteners to connect the bucket or scoop to the arm or boom, enabling efficient digging and material handling.
- Fasteners secure the tracks or wheels to the chassis, providing stability and mobility.

4. **Dump Trucks:**
   - Fasteners are employed in securing the dump body to the truck's chassis to ensure it can safely carry and dump heavy loads.
   - They are also used in attaching various hydraulic components for lifting and tilting the dump body.
5. **Mining Drills:**
   - Fasteners are crucial in holding the drilling rig components together, including the drill bit and the drilling arm.
   - They secure critical parts of the drilling machinery, ensuring precision and safety during drilling operations.
6. **Haul Trucks:**
   - Fasteners are used to connect the massive tires to the truck's axles, ensuring the truck's ability to transport heavy loads over rough terrain.
   - They are also employed in securing the truck's body and various components related to load hauling.
7. **Excavators:**
   - Fasteners play a role in attaching the boom, arm, and bucket to the excavator's main structure, enabling digging, lifting, and material handling.
   - They secure the undercarriage components, including tracks or wheels, for stability and mobility.
8. **Cranes (used in construction near mining sites):**
   - Fasteners are essential for connecting the crane's boom, jib, and counterweights to the main structure.
   - They secure components of the lifting and hoisting systems, ensuring the crane's ability to handle heavy loads safely.
9. **Loaders (used for material handling in mining operations):**
   - Fasteners are used to secure the loader's bucket, arms, and hydraulics for efficient material loading and transport.
   - They also play a role in attaching specialized attachments for specific mining tasks.

In each of these heavy equipment types, industrial fasteners are vital for assembly, structural integrity, and safety. They help hold together critical components and attachments, ensuring the equipment's reliability and performance in demanding mining and construction environments. Proper fastener selection and maintenance are essential to keep these machines operational and safe for operators and workers.

What are the safety considerations when using industrial fasteners in the applications above?

Safety considerations when using industrial fasteners in heavy equipment and mining applications are crucial to prevent accidents, equipment failures, and potential hazards. Here are some key safety considerations:

1. **Proper Fastener Selection:** Choose fasteners that meet or exceed the equipment manufacturer's specifications and industry standards. Ensure they have the required tensile strength, load-carrying capacity, and corrosion resistance for the specific application.
2. **Torque and Tightening Procedures:** Follow manufacturer-recommended torque values and tightening procedures when installing fasteners. Over-tightening or under-tightening can lead to fastener failure. Consider using torque wrenches for precision.
3. **Inspection and Maintenance:** Regularly inspect fasteners for signs of wear, damage, or corrosion. Replace any damaged or worn fasteners promptly. Implement a maintenance schedule to ensure the integrity of critical connections.
4. **Proper Thread Engagement:** Ensure that threads engage fully and evenly when tightening fasteners. Incomplete thread engagement can lead to weak connections and potential failure.
5. **Thread Lubrication:** Use the recommended lubricants or anti-seize compounds on fasteners to prevent galling and ensure consistent torque application during tightening.
6. **Thread Locking Devices:** In applications with vibration or dynamic loads, consider using thread locking devices like thread-locking adhesives or locking washers to prevent fastener loosening.

7. **Surface Preparation:** Prepare the surfaces to be fastened by cleaning them thoroughly and removing any contaminants, rust, or debris. Proper surface preparation ensures a secure connection.
8. **Safety Equipment:** Provide workers with appropriate personal protective equipment (PPE), such as gloves and eye protection, when handling fasteners or performing maintenance involving fasteners.
9. **Training and Education:** Ensure that personnel involved in fastener installation and maintenance receive proper training. They should be aware of safety protocols and understand the importance of correct fastener procedures.
10. **Documentation:** Maintain records of fastener installation, torque values, and inspections. This documentation helps track maintenance schedules and ensures compliance with safety protocols.
11. **Environmental Considerations:** Be mindful of environmental conditions, such as extreme temperatures or corrosive environments, which may affect fastener performance. Select fasteners and materials that can withstand these conditions.
12. **Emergency Procedures:** Have emergency procedures in place in case of fastener failures or accidents. These procedures should include how to safely disassemble equipment and address fastener-related issues.
13. **Load Distribution:** Consider the load distribution across fasteners. Uneven loads can lead to stress concentrations and fastener failure. Use load-spreading devices or techniques when necessary.
14. **Regular Inspections:** Conduct regular equipment inspections, including fasteners, to identify and address any potential issues before they become safety hazards.
15. **Compliance with Regulations:** Ensure compliance with industry regulations and standards related to fasteners, equipment safety, and maintenance.

By adhering to these safety considerations, companies can reduce the risk of accidents and equipment failures related to industrial fasteners in heavy equipment and mining applications. Implementing a proactive approach to fastener maintenance and safety contributes to safer working conditions and longer equipment lifespan.

What industrial fasteners are used in conjunction with track pads on the heavy equipment?

Track pads are commonly used on heavy equipment with tracks, such as bulldozers, excavators, and crawler cranes, to improve traction, reduce wear on the track links, and protect surfaces like roads or delicate terrain. Industrial fasteners used in conjunction with track pads play a critical role in securing these pads to the track shoes. Here are some of the industrial fasteners commonly used for this purpose:

1. **Track Bolts and Nuts:** Track bolts are typically large, heavy-duty bolts with a tapered head designed to fit into the countersunk holes on the track pads. They pass through the track pad, the track shoe, and sometimes additional spacers or washers before being secured with track nuts. These bolts and nuts are often made of high-strength steel to withstand the forces exerted on them during equipment operation.
2. **Master Pins and Bushings:** In certain track systems, master pins and bushings are used to connect the track shoes, and these may be secured with snap rings or other fasteners. While not directly securing the track pads, they are integral components of the track assembly.
3. **Lock Washers:** Lock washers, such as split lock washers or Belleville washers, can be used in conjunction with track bolts and nuts to provide additional resistance to loosening due to vibration or movement.
4. **Thread Locking Adhesives:** In applications where vibration and shock loads are a concern, thread locking adhesives or compounds may be applied to the threads of track bolts and nuts to prevent them from loosening over time.
5. **Retaining Rings:** Retaining rings, often used in conjunction with master pins, can secure components in place and prevent unintended disassembly.
6. **Track Shoe Hardware Kits:** These kits may include a combination of the above fasteners, along with any additional components required for the specific track pad and track shoe design.

It's important to note that the exact type and specifications of fasteners used with track pads can vary depending on the equipment manufacturer, the specific model of heavy equipment, and the intended application. Manufacturers typically provide guidelines and specifications for the correct fasteners to use with their equipment.

Regular inspection and maintenance of track pads and their associated fasteners are essential to ensure the safe and efficient operation of heavy equipment with tracked undercarriages. Properly securing track pads not only prevents them from coming loose during operation but also helps extend the life of the track system and reduces the risk of damage to the underlying surfaces.

What is the common maintenance practice involving fasteners in the heavy equipment and mining industries?

Maintenance practices involving fasteners in the heavy equipment and mining industries are crucial to ensure equipment safety, reliability, and longevity. Here are common maintenance practices related to fasteners in these industries:

1. **Regular Inspections:** Implement a routine inspection schedule to check the condition of fasteners. This includes looking for signs of wear, corrosion, loose fasteners, and missing components. Inspections should cover all critical connections and fastener types throughout the equipment.
2. **Tightening and Torque Checks:** Verify that fasteners are properly tightened according to manufacturer-recommended torque specifications. Check for any fasteners that have loosened due to vibration or stress and retighten them as necessary. Use torque wrenches for precision tightening.
3. **Fastener Replacement:** Replace damaged or worn fasteners promptly. Damaged fasteners can compromise the equipment's structural integrity and safety. Keep a stock of replacement fasteners and hardware readily available.
4. **Lubrication and Anti-Seize Compounds:** Apply the appropriate lubricants or anti-seize compounds to fasteners as recommended by the manufacturer. These substances can prevent galling, ensure even torque application, and help protect against corrosion.
5. **Thread Locking:** In applications with vibration or dynamic loads, consider using thread-locking adhesives to prevent fastener loosening. Follow the manufacturer's guidelines for the proper application of these adhesives.

6. **Environmental Considerations:** Be aware of the environmental conditions in which equipment operates. Extreme temperatures, corrosive environments, and exposure to chemicals can affect fastener performance. Select fasteners that can withstand these conditions.
7. **Record Keeping:** Maintain detailed records of fastener inspections, replacements, and torque values. This documentation helps track maintenance history and ensures compliance with safety and maintenance protocols.
8. **Training and Education:** Train personnel involved in maintenance on the importance of proper fastener care and maintenance. Ensure they are familiar with safety protocols and the correct procedures for handling fasteners.
9. **Load Distribution:** Check for even load distribution across fasteners. Uneven loads can lead to stress concentrations and fastener failure. Implement load-spreading devices or techniques when needed.
10. **Emergency Procedures:** Establish emergency procedures for addressing fastener-related failures or accidents. These procedures should include guidelines for safely disassembling equipment and addressing fastener issues in emergency situations.
11. **Compliance with Regulations:** Ensure that maintenance practices related to fasteners comply with industry regulations and standards. Staying up-to-date with relevant safety guidelines is essential.
12. **Supplier and Manufacturer Guidance:** Collaborate with fastener suppliers and equipment manufacturers to access expert guidance on fastener selection, maintenance, and replacement practices specific to your equipment and applications.

By following these maintenance practices, heavy equipment and mining industry professionals can enhance safety, extend equipment lifespan, minimize downtime, and reduce the risk of accidents or failures associated with fasteners. Regular inspections and proactive maintenance are key to ensuring the reliability and performance of these critical components.

LNG INDUSTRY AND FASTENERS

The liquefied natural gas (LNG) industry involves various components and infrastructure that utilize industrial fasteners for construction, maintenance, and safety purposes. Some of the key components and areas within the LNG industry where industrial fasteners are commonly used include:

1. **LNG Storage Tanks:**
   - LNG storage tanks are a critical part of LNG facilities. Fasteners are used in the construction of these tanks to securely join and seal various components, such as the tank walls, roof, and insulation.
2. **Pipelines and Piping Systems**:
   - Industrial fasteners are used to connect and secure pipes, valves, and fittings throughout the LNG facility, including in the pipelines that transport LNG from the storage tanks to processing units and distribution points.
3. **LNG Processing Equipment:**
   - Various processing equipment, such as heat exchangers, compressors, and separators, require fasteners for assembly and maintenance. These fasteners ensure that the equipment operates efficiently and safely.
4. **LNG Loading and Unloading Systems:**
   - Fasteners are used in the construction of loading and unloading systems, including the connections between LNG carriers and onshore or offshore terminals. This ensures the safe transfer of LNG.
5. **LNG Transportation:**
   - LNG carriers, which transport liquefied natural gas across long distances, rely on fasteners for the construction and maintenance of the ship's hull, cargo containment systems, and various components on board.
6. **LNG Facilities Infrastructure:**
   - LNG facilities often include infrastructure such as access platforms, walkways, safety barriers, and storage structures. Industrial fasteners are essential for constructing and maintaining these facilities to ensure safety and accessibility.

7. **Safety Systems:**
   - Safety systems in LNG facilities, including fire suppression systems, emergency shutdown systems, and safety barriers, require fasteners to ensure their proper functioning and reliability during emergencies.
8. **Cryogenic Insulation:**
   - LNG is stored and transported at extremely low temperatures. Fasteners are used in the installation of cryogenic insulation materials to maintain the required temperature conditions and prevent heat transfer.
9. **LNG Export and Import Terminals:**
   - LNG terminals, whether for exporting or importing LNG, rely on fasteners for the construction and maintenance of loading and unloading facilities, storage tanks, and associated infrastructure.
10. **LNG Compressor and Liquefaction Facilities:**
    - In liquefaction facilities, where natural gas is converted into LNG, and in compressor stations along the LNG supply chain, industrial fasteners are used in the construction and maintenance of critical equipment and pipelines.
11. **LNG Vaporization Units:**
    - In regasification units, where LNG is converted back into natural gas for distribution, fasteners are used to assemble and maintain equipment like vaporizers and heat exchangers.

Industrial fasteners used in the LNG industry are typically selected for their corrosion resistance, durability, and ability to withstand extreme temperatures, as LNG facilities often operate in harsh environmental conditions. Properly installed and maintained fasteners are crucial for the safety, integrity, and reliability of LNG infrastructure.

How are industrial fasteners used in the areas listed above?

Industrial fasteners play a crucial role in various areas within the liquefied natural gas (LNG) industry, and their specific applications can vary depending on the component or infrastructure. Here's how industrial fasteners are commonly used in the areas listed above:

1. **LNG Storage Tanks**:
    - Fasteners are used to secure the tank walls and roof in place.
    - Gaskets and seals are often used in conjunction with fasteners to ensure a leak-free and secure containment system.
    - Insulation panels are attached to the tank structure using fasteners to maintain low temperatures.
2. **Pipelines and Piping Systems**:
    - Flange bolts and nuts are used to connect pipe sections and attach them to valves and fittings.
    - Bolts, nuts, and gaskets help create sealed connections to prevent leaks in high-pressure and cryogenic pipelines.
3. **LNG Processing Equipment**:
    - Fasteners are used to assemble and secure various components of processing equipment, including heat exchangers, compressors, and separators.
    - They are crucial for maintaining the integrity and stability of these critical systems.
4. **LNG Loading and Unloading Systems**:
    - Fasteners secure the connections between LNG carriers and onshore or offshore terminals.
    - They ensure a safe and reliable transfer of LNG from the carrier to the storage tanks or vice versa.
5. **LNG Transportation**:
    - Fasteners are used in the construction and maintenance of the ship's hull, cargo containment systems, and various components on LNG carriers.
    - These fasteners must withstand the harsh marine environment.
6. **LNG Facilities Infrastructure**:
    - Fasteners are used in the construction of access platforms, walkways, safety barriers, and storage structures within LNG facilities.
    - They ensure the structural integrity and safety of these infrastructure elements.
7. **Safety Systems**:

- Fasteners secure the components of safety systems, such as fire suppression equipment, emergency shutdown valves, and safety barriers.
- Reliability is critical in ensuring that these systems function as intended during emergencies.

8. **Cryogenic Insulation**:
   - Fasteners are used to attach and secure cryogenic insulation materials to various components and surfaces to maintain low temperatures.
9. **LNG Export and Import Terminals**:
   - Fasteners are used in the construction and maintenance of loading and unloading facilities, storage tanks, and associated infrastructure.
   - They are vital for ensuring the safety and operational efficiency of these terminals.
10. **LNG Compressor and Liquefaction Facilities**:
    - Fasteners secure the equipment used in liquefaction and compression processes, including pipelines, compressors, and heat exchangers.
    - They help maintain the structural integrity of these facilities.
11. **LNG Vaporization Units**:
    - Fasteners are used in the construction and maintenance of vaporizers, heat exchangers, and associated equipment.
    - Properly installed fasteners are essential for the safe and efficient regasification of LNG.

In all of these areas, the choice of fasteners is critical, as they must meet specific requirements related to material strength, corrosion resistance, and temperature resistance. Additionally, proper installation and maintenance of these fasteners are essential to ensure the safety, reliability, and longevity of LNG infrastructure.

What are the procedures used for securing fasteners in the above applications?

Securing fasteners in the various applications within the liquefied natural gas (LNG) industry involves specific procedures to ensure the integrity, safety, and reliability of the infrastructure. Here are the general procedures used for securing fasteners in the mentioned applications:

1. **LNG Storage Tanks**:
    - Bolts and nuts are tightened to specific torque values using calibrated torque wrenches.
    - Proper sequence and pattern are followed when tightening to ensure even distribution of stress.
    - Gaskets and seals are inspected for integrity and replaced as needed.
    - Visual and ultrasonic inspections may be performed to check for tightness and integrity.
2. **Pipelines and Piping Systems**:
    - Flange connections are assembled with bolts and nuts, and gaskets are inserted between flange faces.
    - Bolts are tightened in a cross-pattern to ensure even pressure distribution.
    - Bolts are torqued to specified values or may undergo tensioning methods to achieve the desired load.
    - The use of lubricants or anti-seize compounds may be considered to facilitate proper tightening.
3. **LNG Processing Equipment**:
    - Manufacturer specifications and guidelines are followed for assembling and securing equipment components.
    - Bolts, nuts, and fasteners are torqued or tensioned to manufacturer-recommended values.
    - Inspection and quality control processes ensure that fasteners are properly installed.
4. **LNG Loading and Unloading Systems**:
    - Fasteners used in these systems are subject to rigorous inspection and quality control procedures to ensure their reliability.
    - Proper bolting sequences and torque specifications are followed during installation.
    - Fasteners are inspected for corrosion or wear during regular maintenance.
5. **LNG Transportation**:
    - Fasteners used in LNG carriers are installed and maintained according to the ship's maintenance and inspection protocols.

- Due to the harsh marine environment, corrosion-resistant materials are often used, and regular inspections are essential.

6. **LNG Facilities Infrastructure**:
   - Fasteners used in infrastructure construction are installed according to engineering plans and structural requirements.
   - Bolts, nuts, and anchors are tightened to specified torque values or tensioned as needed.
   - Regular inspections ensure the structural integrity of infrastructure components.
7. **Safety Systems**:
   - Fasteners securing safety components are installed following manufacturer guidelines and industry standards.
   - Proper torque values and sequences are followed to ensure the reliability of safety systems.
   - Regular functional tests and inspections are conducted to verify the effectiveness of these systems.
8. **Cryogenic Insulation**:
   - Fasteners used for attaching cryogenic insulation materials are installed according to insulation system specifications.
   - Proper spacing and alignment are crucial to maintaining the insulating properties of the material.
   - Insulation joints are sealed to prevent moisture ingress.
9. **LNG Export and Import Terminals**:
   - Installation of fasteners in terminal infrastructure follows engineering designs and specifications.
   - Bolts, nuts, and other fasteners are torqued or tensioned as required, with proper inspection and quality control measures in place.
10. **LNG Compressor and Liquefaction Facilities**:
    - Fasteners securing critical equipment are installed according to manufacturer recommendations and industry standards.
    - Regular inspections and maintenance ensure the integrity of fasteners in high-stress environments.
11. **LNG Vaporization Units**:
    - Installation of fasteners in vaporization units follows manufacturer guidelines and engineering specifications.
    - Proper torque or tensioning procedures are used to secure fasteners.

- Inspections and maintenance checks are carried out to verify the performance of the vaporization equipment.

In all cases, safety, quality control, and adherence to industry standards and regulations are paramount. Proper documentation and record-keeping of fastener installation and maintenance activities are essential to ensure the long-term reliability and safety of LNG infrastructure. Regular inspections and preventive maintenance programs help identify and address issues with fasteners before they can lead to failures or leaks.

What maintenance procedures must be used to insure secure fasteners in the above applications?

Maintaining secure fasteners in the various applications within the liquefied natural gas (LNG) industry is essential for ensuring the integrity, safety, and reliability of the infrastructure. Here are some maintenance procedures that must be used to ensure secure fasteners in the mentioned applications:

1. **Regular Inspections**:
    - Conduct routine visual inspections of fasteners to check for signs of loosening, corrosion, or damage.
    - Inspect gaskets and seals for wear, degradation, or leakage.
    - Use non-destructive testing methods like ultrasonic or magnetic particle inspection to detect hidden defects in critical fastener components.
2. **Torque Verification**:
    - Periodically verify the torque settings of critical fasteners to ensure they remain within specified limits.
    - Retorque fasteners if they have become loose due to temperature fluctuations or operational stresses.
3. **Tension Testing**:
    - In high-stress applications, consider periodic tension testing of fasteners to ensure they maintain their specified load-bearing capacity.

- This may involve using tensioning equipment to measure and adjust the tension in bolts.

4. **Lubrication and Anti-Corrosion Measures**:
   - Apply appropriate lubricants or anti-seize compounds to fasteners when necessary to prevent galling and ensure proper torque application.
   - Implement corrosion prevention measures, such as coatings or corrosion-resistant fasteners, in corrosive environments.
5. **Replacement of Fasteners**:
   - Replace fasteners that are damaged, corroded, or otherwise compromised.
   - Follow manufacturer recommendations and industry standards for selecting suitable replacement fasteners.
6. **Gasket and Seal Maintenance**:
   - Replace gaskets and seals at regular intervals or when signs of wear or leakage are detected.
   - Ensure that gasket materials are compatible with the process conditions.
7. **Bolting Sequence and Pattern Checks**:
   - Confirm that the correct bolting sequence and pattern are followed when reassembling flange connections and critical joints.
   - Ensure that the correct torque values are applied in the proper order.
8. **Environmental Monitoring**:
   - Monitor environmental conditions in the vicinity of fasteners to identify potential issues caused by temperature fluctuations or exposure to corrosive substances.
   - Implement protective measures as needed.
9. **Fastener Documentation**:
   - Maintain detailed records of fastener installation, torque values, tensioning procedures, and maintenance activities.
   - Record any deviations, replacements, or repairs for auditing and future reference.
10. **Safety System Testing**:
    - Regularly test the functionality of safety systems that rely on fasteners to ensure they operate correctly in emergency situations.

- Conduct functional tests and drills as part of the maintenance routine.

11. **Training and Certification**:
    - Ensure that personnel responsible for fastener maintenance are adequately trained and certified in proper installation and maintenance procedures.
    - Stay updated with industry best practices and safety standards.
12. **Emergency Response Planning**:
    - Have a well-defined emergency response plan in place in case of fastener failures or leaks.
    - Ensure that personnel are trained in responding to emergency situations involving fasteners.
13. **Risk Assessment**:
    - Periodically conduct risk assessments to identify potential failure points in the infrastructure and prioritize maintenance efforts accordingly.
14. **Predictive Maintenance**:
    - Implement predictive maintenance techniques, such as vibration analysis or thermal imaging, to detect early signs of fastener issues before they lead to failures.

Regular and proactive maintenance is crucial for the safe and reliable operation of LNG infrastructure. Properly maintained fasteners help prevent leaks, accidents, and costly downtime, making them a critical aspect of LNG facility management.

What safety considerations must be adhered to when using industrial fasteners in the above applications?

Safety considerations are of paramount importance when using industrial fasteners in the various applications within the liquefied natural gas (LNG) industry. Adhering to safety protocols and standards is essential to prevent accidents, ensure the integrity of the infrastructure, and protect personnel. Here are some safety considerations that must be followed:

1. **Personal Protective Equipment (PPE)**:

- Workers involved in fastener installation, maintenance, and inspections must wear appropriate PPE, including safety goggles, helmets, gloves, and steel-toed boots.
- In environments with potential exposure to hazardous substances, such as cryogenic fluids or corrosive materials, specialized PPE may be required.

2. **Workplace Safety**:
   - Ensure that work areas are properly marked and cordoned off to prevent unauthorized access and protect workers from hazards.
   - Follow workplace safety protocols, including procedures for working at heights, confined spaces, and other potentially dangerous areas.
3. **Tool Safety**:
   - Use calibrated and properly maintained torque wrenches, tensioning equipment, and other tools for fastener installation and maintenance.
   - Train personnel in the safe use of tools to prevent accidents and ensure accurate torque or tension application.
4. **Fastener Material Selection**:
   - Choose fasteners made from materials suitable for the specific application and environmental conditions, considering factors like corrosion resistance, temperature resistance, and strength.
   - Ensure compatibility between fastener materials and the materials they connect (e.g., flanges, pipes).
5. **Proper Installation Techniques**:
   - Follow manufacturer guidelines and industry standards for the correct installation of fasteners, including torque specifications and bolting sequences.
   - Avoid over-tightening or under-tightening, as this can compromise the integrity of fasteners and connections.
6. **Bolting Patterns and Sequences**:
   - Use the proper bolting pattern and sequence when assembling flanges and joints to ensure even distribution of load and prevent gasket or seal damage.
   - Avoid diagonal or uneven tightening that may lead to leaks or fastener failures.
7. **Fastener Inspection**:

- Conduct regular visual inspections of fasteners to identify signs of corrosion, damage, or loosening.
- Implement non-destructive testing methods, such as ultrasonic testing or magnetic particle inspection, to detect hidden defects in critical fasteners.

8. **Gasket and Seal Inspection**:
    - Inspect gaskets and seals for wear, damage, or signs of leakage.
    - Replace gaskets and seals according to manufacturer recommendations and industry standards.
9. **Environmental Hazards**:
    - Be aware of environmental hazards associated with LNG, including flammable gases and cryogenic temperatures.
    - Implement safety measures, such as gas detection systems, in areas where LNG is handled.
10. **Emergency Response**:
    - Have a well-defined emergency response plan in place in case of fastener failures, leaks, or other incidents.
    - Train personnel in emergency response procedures, including isolation, evacuation, and containment measures.
11. **Lockout/Tagout Procedures**:
    - Implement lockout/tagout procedures to ensure equipment and systems are safely de-energized and secured during maintenance activities involving fasteners.
12. **Safety Systems and Equipment**:
    - Ensure that safety systems, such as emergency shutdown systems and fire suppression equipment, are properly installed, tested, and maintained.
    - Conduct regular functional tests and drills to verify their effectiveness.
13. **Training and Certification**:
    - Ensure that personnel involved in fastener-related tasks are trained and certified in safety procedures and best practices.
    - Provide ongoing training and refresher courses to keep personnel up to date.
14. **Risk Assessment**:

- Periodically conduct risk assessments to identify potential safety hazards related to fasteners and implement appropriate mitigation measures.

15. **Documentation and Reporting**:
    - Maintain detailed records of fastener installation, maintenance, and inspection activities.
    - Report any safety concerns, incidents, or near-misses promptly to management and relevant authorities.

Safety is a shared responsibility within the LNG industry, and adherence to safety standards and protocols is crucial to protect personnel, the environment, and the integrity of LNG infrastructure. Regular safety audits and continuous improvement efforts help maintain a culture of safety throughout LNG facilities.

OIL REFINERY FASTENERS

Fasteners play a crucial role in various applications within an oil refinery. They are essential for ensuring the safety, integrity, and functionality of equipment and structures in the harsh and demanding environment of a refinery. Here are some of the different applications that require fasteners in an oil refinery:

1. **Piping and Pipelines**: Fasteners are used to connect and secure pipes and pipelines that transport crude oil, refined products, and various chemicals within the refinery. Flange bolts, nuts, and gaskets are commonly used to create leak-tight connections.
2. **Pressure Vessels**: Fasteners are used to assemble and secure the components of pressure vessels, which are used for storing and processing gases and liquids at high pressures and temperatures. These fasteners must be able to withstand extreme stress and temperature conditions.
3. **Tanks and Storage Facilities**: Storage tanks for crude oil, chemicals, and refined products rely on fasteners to maintain their structural integrity. Fasteners are used to secure the tank walls, roofs, and other components.
4. **Heat Exchangers**: Fasteners are used to hold together the plates, tubes, and fins of heat exchangers. Heat exchangers play a critical role in transferring heat between different fluids in the refining process.
5. **Distillation Towers**: Fasteners are used in the construction of distillation towers, which are essential for separating crude oil into its various components. These towers require sturdy fasteners to withstand the forces generated during the separation process.
6. **Reactors and Catalytic Converters**: Fasteners are used to assemble reactors and catalytic converters, which are key components in various refining processes, including cracking and hydrocracking.
7. **Flare Systems**: Fasteners secure the components of flare systems, which are used to burn off excess gases to prevent the release of harmful pollutants and potential safety hazards.

8. **Pumps and Compressors**: Fasteners are used in the assembly of pumps and compressors that are crucial for fluid transportation and pressure management within the refinery.
9. **Support Structures**: Fasteners are used to build and maintain support structures such as platforms, walkways, staircases, and ladders, which are necessary for accessing different areas of the refinery and performing maintenance tasks.
10. **Instrumentation and Control Systems**: Fasteners are used to secure instruments, control panels, and electrical components throughout the refinery, ensuring accurate monitoring and control of the refining processes.
11. **Safety Equipment**: Fasteners are used in safety equipment such as emergency shutdown systems, fire suppression systems, and safety barriers, contributing to the overall safety of the refinery.

Given the harsh operating conditions in an oil refinery, fasteners used in these applications must be selected based on factors such as corrosion resistance, high temperature resistance, and mechanical strength to ensure long-term performance and safety.

What type of tools are used to secure fasteners in oil refineries?

Various types of tools are used to secure fasteners in oil refineries, considering the diverse range of applications and the specific requirements of each fastening task. These tools ensure that fasteners are properly tightened, secured, and maintained to maintain the safety and efficiency of refinery operations. Some common tools used to secure fasteners in oil refineries include:

1. **Wrenches and Spanners**: These tools come in various shapes and sizes and are used to tighten and loosen nuts and bolts. Adjustable wrenches, combination wrenches, and socket wrenches are commonly used in refineries.
2. **Torque Wrenches**: Torque wrenches are designed to apply a specific amount of torque (twisting force) to a fastener. They are essential for

ensuring that fasteners are tightened to the correct specifications, preventing both under-tightening and over-tightening.

3. **Impact Wrenches**: Impact wrenches, also known as pneumatic wrenches or air guns, use compressed air to deliver rapid bursts of torque. They are particularly useful for quickly tightening or loosening large and stubborn fasteners.
4. **Hydraulic Torque Wrenches**: These tools use hydraulic pressure to apply precise torque to fasteners. They are often used in applications that require very high torque levels or in confined spaces.
5. **Bolt Tensioning Tools**: Bolt tensioning tools are used to apply a controlled amount of tension directly to the bolt, ensuring consistent and accurate tightening across a range of fasteners.
6. **Stud Tensioning Tools**: These tools are used specifically for tightening studs and stud bolts. They ensure that the studs are uniformly tensioned to prevent leakage in high-pressure applications.
7. **Nut Runners**: Nut runners are tools designed to rapidly tighten or loosen nuts, often used in assembly lines and maintenance tasks.
8. **Threaded Insert Tools**: Threaded inserts are used to reinforce or repair threads in materials. Tools like thread taps and thread repair kits are used to install these inserts.
9. **Thread Locking Compounds**: While not traditional tools, thread locking compounds are used to secure fasteners by preventing them from loosening due to vibrations and other forces.
10. **Lubrication and Anti-Seize Compounds**: These substances are used to lubricate fasteners during installation, reducing friction and the risk of galling. Anti-seize compounds also prevent corrosion and make future maintenance easier.
11. **Calibrated Torque Wrench Testers**: These tools are used to calibrate and verify the accuracy of torque wrenches regularly to ensure that they are applying the intended torque values.
12. **Calibrated Torque Calibration Systems**: These systems are used to calibrate and adjust torque wrenches and other torque application tools to ensure accurate torque output.

It's important to note that the selection of the appropriate tool depends on the specific fastener type, size, and the required torque specifications. Regular maintenance, calibration, and training for using these tools are crucial to ensure that fasteners are properly secured and that refinery operations remain safe and efficient.

What are the most important safety considerations when securing fasteners within an oil refinery?

Safety is of paramount importance when working with fasteners in an oil refinery due to the hazardous and potentially volatile environment. Proper installation and maintenance of fasteners contribute to the overall safety and integrity of the refinery. Here are some critical safety considerations to keep in mind when securing fasteners within an oil refinery:

1. **Proper Training and Competency**: Ensure that personnel involved in fastener installation and maintenance are properly trained, competent, and aware of the specific procedures and safety protocols for each type of fastener and application.
2. **Torque Specifications**: Follow manufacturer's torque specifications and guidelines for each type of fastener. Over-tightening or under-tightening can compromise the integrity of the fastener, leading to leaks, failures, or unsafe conditions.
3. **Use of Correct Tools**: Select and use the appropriate tools for the specific type of fastener and application. Incorrect tools can result in improper torque application, which can lead to fastener failure or damage.
4. **Calibration of Torque Tools**: Regularly calibrate torque wrenches and other torque application tools to ensure they provide accurate torque values. Using uncalibrated tools can lead to inaccurate fastener tightening.
5. **Proper Lubrication and Anti-Seize Compounds**: Use approved lubrication and anti-seize compounds to reduce friction and the risk of galling during installation. This promotes proper torque application and prevents damage to fasteners.

6. **Thread Integrity**: Ensure the threads of both fasteners and mating parts are clean and undamaged before installation. Damaged threads can lead to improper engagement and reduced fastener integrity.
7. **Environmental Factors**: Consider the operating environment, including temperature, pressure, corrosive chemicals, and vibration. Choose fasteners and materials that can withstand these conditions to prevent degradation and failure.
8. **Thread Locking Compounds**: In applications where vibration or movement is a concern, consider using thread locking compounds to prevent fasteners from loosening over time.
9. **Inspection and Maintenance**: Regularly inspect fasteners for signs of corrosion, wear, and damage. Replace any fasteners that show signs of degradation to prevent potential failures.
10. **Proper Sequence and Tightening Patterns**: Follow the recommended tightening sequence and pattern when securing multiple fasteners, such as flange bolts. This ensures even distribution of force and prevents distortion of the assembly.
11. **Safety Equipment**: Use appropriate personal protective equipment (PPE), including gloves, safety glasses, and appropriate clothing, when working with fasteners. This is particularly important in environments where chemicals, heat, and other hazards are present.
12. **Confined Space Awareness**: In confined spaces, ensure proper ventilation and adhere to confined space entry protocols. Fastener work in such areas may require specialized training and safety measures.
13. **Lockout/Tagout**: When working on equipment that may be energized or in operation, follow lockout/tagout procedures to prevent accidental startup and ensure the safety of personnel.
14. **Emergency Procedures**: Make sure all personnel are aware of emergency shutdown procedures and evacuation routes in case of fastener failures or other safety incidents.
15. **Documentation**: Maintain accurate records of fastener installation, torque values, and maintenance activities. This documentation can be valuable for future inspections and troubleshooting.

By following these safety considerations and implementing best practices, refinery operators can help ensure the reliability and safety of fasteners in critical applications, contributing to the overall success of the facility.

What are issues to avoid when securing fasteners within an oil refinery?

When securing fasteners within an oil refinery, there are several common issues that should be avoided to ensure the safety, integrity, and functionality of the equipment and structures. Here are some key issues to be aware of and avoid:

1. **Insufficient Torque or Over-Tightening**: Applying insufficient torque can result in loose fasteners that may lead to leaks or equipment failure. Conversely, over-tightening can strip threads, damage the fastener, or distort the components being fastened. Follow manufacturer's torque specifications carefully.
2. **Incorrect Tool Selection**: Using the wrong type or size of tool can lead to improper torque application, resulting in under-tightened or over-tightened fasteners. Always use the correct tool for the specific fastener and application.
3. **Improper Lubrication**: Applying incorrect or excessive lubrication or anti-seize compounds can alter the torque-tension relationship and lead to inconsistent or inaccurate torque values.
4. **Ignoring Environmental Factors**: Failing to consider the operating environment, including temperature variations, exposure to corrosive chemicals, and vibration, can lead to fastener degradation and failure.
5. **Incorrect Fastener Selection**: Using fasteners made from the wrong material or with inadequate corrosion resistance can lead to premature deterioration and weakening of the fasteners.
6. **Thread Damage or Misalignment**: Damaged or misaligned threads on either the fastener or the mating part can result in incomplete engagement, reduced fastener strength, and increased risk of leaks.

7. **Inadequate Inspection and Maintenance**: Neglecting regular inspection and maintenance of fasteners can lead to missed signs of corrosion, wear, or damage, increasing the risk of unexpected failures.
8. **Skipping Torque Wrench Calibration**: Using torque tools that are not properly calibrated can result in incorrect torque application, compromising the integrity of the fasteners.
9. **Ignoring Tightening Patterns**: Failing to follow recommended tightening sequences and patterns for multiple fasteners, such as flange bolts, can lead to uneven distribution of force and improper sealing.
10. **Improper Handling and Storage**: Mishandling or improper storage of fasteners can cause damage, such as deformation or contamination, which can affect their performance.
11. **Improper Use of Thread Locking Compounds**: Incorrect application of thread locking compounds can lead to issues such as over-application, which can affect torque accuracy, or under-application, which may not prevent fastener loosening as intended.
12. **Inadequate Training and Supervision**: Insufficient training and lack of supervision can lead to inexperienced personnel making errors in fastener installation, potentially compromising safety and reliability.
13. **Ignoring Safety Protocols**: Neglecting safety protocols, such as confined space entry procedures or lockout/tagout practices, can result in accidents, injuries, or damage to equipment.
14. **Inadequate Documentation**: Failing to maintain accurate records of fastener installation, torque values, and maintenance activities can make it challenging to track fastener history and perform necessary inspections.
15. **Rushing Installation**: Haste can lead to mistakes in fastener installation, such as uneven tightening or incomplete engagement, which can compromise the integrity of the assembly.

By being aware of these issues and taking proactive measures to prevent them, oil refinery operators can minimize the risk of fastener-related problems and ensure the safety and reliability of their operations.

What is the biggest danger inside an oil refinery involving fasteners?

One of the biggest dangers inside an oil refinery involving fasteners is the potential for leaks and releases of hazardous materials due to improperly secured or failing fasteners. Leaks can lead to a range of safety and environmental hazards, including fires, explosions, toxic chemical exposure, and environmental pollution. The following are some key factors that contribute to the danger of leaks caused by fastener issues within an oil refinery:

1. **Pressure and Vibration**: Oil refineries often involve high-pressure processes and equipment, and many fasteners are used to maintain the integrity of pressurized systems. If fasteners are not properly secured, tightened, or maintained, the pressure and vibration from the processes can cause them to loosen, leading to leaks.
2. **Chemical Exposure**: Fasteners are exposed to a variety of chemicals and corrosive substances used in the refining process. If fasteners are not chosen for their chemical resistance or if they corrode over time, they can lose their integrity and result in leaks.
3. **Temperature Fluctuations**: Refineries operate under a range of temperatures, from extreme heat to freezing cold. Thermal expansion and contraction can affect the tightness of fasteners if they were not properly torqued in the first place.
4. **Sealing and Integrity**: Many fasteners play a role in sealing critical components, such as flanges and gaskets, which prevent leaks. If fasteners are not properly tightened or if there are issues with gaskets, the integrity of the seal can be compromised.
5. **Equipment and Structural Failures**: Fasteners secure equipment and structures within the refinery. If fasteners fail due to incorrect installation or degradation over time, it can lead to the collapse of equipment or structures, posing a significant safety risk to personnel.

6. **Ignition Sources**: Leaking fluids within a refinery can come into contact with ignition sources such as hot surfaces, open flames, or electrical equipment, potentially leading to fires or explosions.
7. **Toxic Exposure**: Leaks involving hazardous chemicals or gases can expose workers to toxic substances, resulting in health risks or immediate injury.
8. **Environmental Impact**: Leaked chemicals can harm the environment by contaminating soil, water sources, and air, leading to environmental damage and potential regulatory violations.
9. **Emergency Shutdowns**: Leaks can prompt emergency shutdowns of equipment or processes, disrupting refinery operations and potentially causing additional safety hazards during shutdown procedures.
10. **Escalation of Incidents**: A single leaking fastener can escalate into a larger incident if not promptly addressed. For example, a small leak can lead to a larger spill, fire, or explosion if not managed effectively.

To mitigate these dangers, oil refineries must prioritize proper fastener selection, installation, and maintenance. Regular inspections, adherence to torque specifications, training of personnel, and strict adherence to safety protocols are crucial to prevent fastener-related leaks and associated risks.

What maintenance procedures are most important when securing fasteners inside an oil refinery?

Maintenance procedures for securing fasteners inside an oil refinery are essential to ensure the ongoing safety, reliability, and efficiency of equipment and structures. Regular maintenance helps identify issues before they escalate into more significant problems. Here are some of the most important maintenance procedures to consider when working with fasteners in an oil refinery:

1. **Regular Inspection**: Perform regular visual inspections of fasteners to identify signs of corrosion, wear, damage, or improper torque. Inspections should cover all critical areas where fasteners are used, including pipes, valves, pressure vessels, and structural components.

2. **Torque Verification**: Periodically verify the torque values of critical fasteners using calibrated torque wrenches or other torque verification methods. Re-torque if necessary to ensure that fasteners are properly tightened according to specifications.
3. **Scheduled Maintenance**: Incorporate fastener inspection and maintenance into scheduled maintenance routines. This can help identify issues early and prevent unexpected failures during operations.
4. **Fastener Replacement**: Replace fasteners that show signs of corrosion, wear, or damage. Using compromised fasteners can lead to leaks or failures.
5. **Gasket Inspection**: Check gaskets and seals in conjunction with fastener inspections. Gaskets play a crucial role in preventing leaks, so any deterioration should be addressed promptly.
6. **Lubrication and Anti-Seize Application**: Reapply approved lubrication and anti-seize compounds during maintenance to ensure proper torque application and prevent corrosion.
7. **Thread Cleaning**: Ensure that threads on both fasteners and mating parts are clean and free of debris during maintenance to ensure proper engagement.
8. **Environmental Considerations**: Take into account the refinery's operating environment when planning maintenance. Address issues such as corrosion caused by exposure to chemicals, extreme temperatures, or humidity.
9. **Tightening Sequence**: If fasteners are part of assemblies with multiple bolts, ensure that the correct tightening sequence and pattern are followed during maintenance.
10. **Documentation**: Maintain accurate records of maintenance activities, including torque values, replacement dates, and any issues identified. Documentation helps track the history of fasteners and assists in future inspections.
11. **Training and Knowledge Sharing**: Provide training to maintenance personnel on proper fastener inspection and maintenance procedures. Share knowledge and lessons learned across the maintenance team to ensure consistent practices.
12. **Emergency Response**: Develop and communicate clear emergency response procedures in case a fastener-related issue leads to leaks or other

safety concerns. Personnel should know how to respond quickly and effectively to prevent escalation.

13. **Vibration Analysis**: Consider implementing vibration analysis to detect any abnormalities in fasteners or equipment that could lead to failures over time.
14. **Bolt Tension Testing**: For critical applications, consider using bolt tension testing equipment to ensure that fasteners are maintaining the appropriate tension levels over time.
15. **Risk Assessment**: Conduct periodic risk assessments to identify areas with the highest risk of fastener-related failures. Allocate resources for more intensive inspections and maintenance in these areas.

By following these maintenance procedures, oil refineries can proactively address fastener-related issues, minimize the risk of leaks and failures, and contribute to a safer and more reliable operating environment.

SECURING FASTENERS IN A SUBSEA ENVIRONMENT

Securing fasteners in a subsea environment is crucial to ensure the integrity and safety of underwater structures and equipment. The subsea environment presents unique challenges such as high pressures, corrosive seawater, and limited accessibility. Proper fastening procedures are essential to prevent equipment failure and maintain the structural integrity of subsea installations. Here's a general outline of the procedure for securing fasteners in a subsea environment:

1. **Material Selection:** Choose fasteners made from materials that are resistant to corrosion and can withstand the harsh conditions of the subsea environment. Stainless steel, duplex stainless steel, and other corrosion-resistant alloys are commonly used.
2. **Preparation:**
    - Ensure that both the fasteners and the mating surfaces are clean and free from debris, rust, grease, and other contaminants.
    - Consider using anti-seize compounds or lubricants suitable for subsea applications to prevent galling and seizing during installation.
3. **Torque and Tension:** Depending on the application, you may need to decide whether to use torque or tension control for fastening. This decision is often influenced by the design specifications and the type of fasteners being used.
4. **Torque Control:**
    - Use a calibrated torque wrench to tighten the fasteners to the specified torque value. The torque value will depend on the fastener size, material, and the design requirements.
    - Follow the recommended torque sequence to evenly distribute the load on the mating surfaces.
5. **Tension Control:**
    - Tension control involves achieving a specific level of tension in the fastener, which is often measured using ultrasonic or hydraulic tensioning equipment.

- The tensioning equipment is used to stretch the fastener to a predetermined load, ensuring consistent and accurate tension across all fasteners.

6. **Bolt Stretch Measurement (if applicable):**
   - In critical subsea applications, bolt stretch measurement might be used to ensure the correct load is applied to the fastener. This can be achieved using load indicating devices or strain gauges.
7. **Inspection:**
   - Once the fasteners are secured, perform visual inspections to ensure that they are properly seated and aligned.
   - Use non-destructive testing methods, such as ultrasound or magnetic particle testing, to detect any potential defects or cracks.
8. **Corrosion Protection:**
   - Apply coatings or inhibitors to protect fasteners from corrosion caused by exposure to seawater. Cathodic protection systems may also be employed to reduce corrosion rates.
9. **Documentation:**
   - Maintain detailed records of the fastening procedure, including torque or tension values applied to each fastener.
   - Document the date of installation, the location of the fasteners, and any inspections or maintenance activities.
10. **Regular Maintenance:**
    - Subsea installations require regular maintenance and inspection to ensure that fasteners remain secure and corrosion-resistant over time. This might involve periodic checks and replacements of fasteners as needed.

It's important to note that specific procedures may vary based on the type of subsea equipment, regulatory requirements, and the engineering standards of the project. Working with experienced subsea engineers, following industry best practices, and adhering to relevant codes and standards are essential for ensuring the success of subsea fastening operations.

What issues need to be avoided when securing fasteners in a subsea environment?

Securing fasteners in a subsea environment is a critical task that comes with several challenges. To ensure the integrity and reliability of subsea installations, it's important to be aware of potential issues and pitfalls that should be avoided. Here are some key issues to watch out for when securing fasteners in a subsea environment:

1. **Corrosion:**
    - Corrosion is a major concern in subsea environments due to the constant exposure to seawater. Fasteners can corrode and weaken over time, leading to structural integrity issues. Use corrosion-resistant materials and coatings to mitigate this issue.
2. **Improper Material Selection:**
    - Choosing the wrong type of fastener material can lead to accelerated corrosion, galvanic corrosion (due to dissimilar metals), and reduced overall performance. Select materials specifically designed for subsea applications.
3. **Inadequate Torque or Tension:**
    - Under-tightening or over-tightening fasteners can lead to joint failure or reduced structural integrity. Follow recommended torque or tension values based on engineering calculations and standards.
4. **Insufficient Inspection and Maintenance:**
    - Neglecting regular inspection and maintenance can lead to undetected issues such as loosened or corroded fasteners. Implement a thorough inspection schedule and perform necessary maintenance activities.
5. **Galling and Seizing:**
    - When working with certain materials, especially stainless steel and other corrosion-resistant alloys, galling (material transfer between mating surfaces) and seizing (stuck fasteners) can occur during installation. Use appropriate lubricants or anti-seize compounds to prevent these issues.

6. **Inaccurate Torque Wrenches:**
   - Using poorly calibrated or inaccurate torque wrenches can result in inconsistent or incorrect fastening torque. Regularly calibrate and maintain your torque tools to ensure accurate readings.
7. **Lack of Alignment:**
   - Improper alignment of fasteners can lead to uneven loads on the joints and mating surfaces, reducing the overall strength and integrity of the connection.
8. **Inadequate Thread Engagement:**
   - Fasteners must be properly threaded and fully engaged to ensure a secure connection. Inadequate thread engagement can result in premature failure.
9. **Environmental Factors:**
   - Subsea environments are subject to various factors such as tidal forces, currents, and underwater sediment movement. These factors can impact the stability and integrity of subsea installations if not accounted for during fastening.
10. **Inadequate Documentation:**
    - Failing to document the fastening process, including torque values applied, maintenance activities, and inspection results, can lead to uncertainties about the reliability of the installation over time.
11. **Vibration and Dynamic Loads:**
    - Subsea equipment can be subjected to vibrations and dynamic loads due to ocean currents and other factors. Fasteners should be able to withstand these forces without loosening.
12. **Installation Errors:**
    - Errors during installation, such as cross-threading, incomplete tightening, or incorrect fastener sizes, can compromise the integrity of the joint.
13. **Failure to Account for Thermal Expansion:**
    - Subsea environments experience temperature fluctuations. Neglecting to account for thermal expansion and contraction can lead to loosening of fasteners as the equipment undergoes temperature changes.

To avoid these issues, it's essential to follow industry best practices, adhere to engineering standards, collaborate with experienced subsea professionals, and conduct thorough testing and inspections. Regular monitoring and maintenance of subsea installations will also contribute to their long-term reliability.

What type of tools would work best for securing fasteners in a subsea environment?

Securing fasteners in a subsea environment requires specialized tools that can withstand the challenging conditions and ensure accurate and reliable fastening. Here are some types of tools that work best for securing fasteners in a subsea environment:

1. **Hydraulic Torque Wrenches:**
    - Hydraulic torque wrenches are commonly used in subsea applications due to their high torque capabilities and ability to achieve precise torque values. They can be used to tighten large or critical fasteners accurately.
2. **Hydraulic Tensioning Tools:**
    - Hydraulic tensioning tools are used to apply a specific tension load to a fastener, ensuring consistent and accurate tightening. They are especially useful for applications where achieving a specific tension is critical.
3. **Subsea Torque Multipliers:**
    - Subsea torque multipliers are designed to provide high torque output with relatively low input force. They are useful for fasteners that require significant torque but can't be accessed with large torque wrenches.
4. **Subsea Bolting Systems:**
    - Subsea bolting systems are specialized tools that are designed to work in underwater environments. They often include hydraulic pumps, tensioning tools, and associated accessories for comprehensive subsea fastening.

5. **ROV-Operated Tools:**
    - Remotely Operated Vehicles (ROVs) are used to operate tools in subsea environments where direct human access is difficult. ROVs can be equipped with specialized fastening tools to perform underwater fastening tasks.
6. **Calibrated Torque Wrenches:**
    - For smaller fasteners, calibrated torque wrenches should be used to achieve accurate torque values. These wrenches should be regularly calibrated to maintain their accuracy.
7. **Load-Indicating Devices:**
    - Load-indicating devices, such as strain gauges or ultrasonic measurement tools, can be used to measure the tension or elongation of fasteners. They ensure accurate and consistent tensioning.
8. **Anti-Seize Applicators:**
    - Anti-seize compounds or lubricants are crucial to prevent galling and seizing of fasteners during installation. Applicators can help evenly apply these substances to the fasteners.
9. **Non-Destructive Testing (NDT) Equipment:**
    - NDT equipment, such as ultrasonic or magnetic particle testing tools, can be used to inspect fasteners and joints for defects or cracks without causing damage to the equipment.
10. **Underwater Torque Measurement Tools:**
    - These tools can be used to measure the torque being applied to a fastener in real-time in underwater conditions, ensuring accurate and controlled tightening.
11. **Divers' Tools:**
    - In situations where direct human intervention is possible, divers may use specialized tools that can function effectively underwater to secure fasteners.
12. **Corrosion Protection Equipment:**
    - Equipment for applying coatings, inhibitors, or cathodic protection systems to fasteners to protect them from corrosion is also important in subsea applications.

The choice of tools will depend on factors such as the size of the fasteners, the specific subsea environment, the required torque or tension values, and the accessibility of the installation site. It's important to use tools that are designed for subsea use, are made from corrosion-resistant materials, and are operated by skilled personnel familiar with subsea installation procedures.

What is the maintenance interval and maintenance procedure for subsea fastener applications?

The maintenance interval and procedure for subsea fastener applications can vary depending on factors such as the type of equipment, the subsea environment, the design specifications, and regulatory requirements. However, here are some general guidelines for establishing a maintenance interval and procedure for subsea fasteners:

Maintenance Interval: The maintenance interval for subsea fasteners will depend on several factors, including the specific equipment, the corrosiveness of the environment, the expected wear and tear, and the manufacturer's recommendations. In many cases, routine inspections and maintenance are performed on an annual basis. However, more critical equipment might require more frequent checks, possibly quarterly or even monthly. It's important to consult with subsea engineers, manufacturers, and regulatory guidelines to determine the appropriate maintenance interval for your specific application.

Maintenance Procedure: Here's a general maintenance procedure for subsea fastener applications:

1. **Visual Inspection:**
    - Regularly inspect subsea equipment for signs of corrosion, wear, or damage. This includes inspecting fasteners, mating surfaces, coatings, and any corrosion protection measures.

2. **Non-Destructive Testing (NDT):**
    - Use non-destructive testing methods such as ultrasonic testing, magnetic particle testing, or radiography to detect hidden defects, cracks, or corrosion beneath the surface.
3. **Torque and Tension Check:**
    - Check the torque or tension of critical fasteners using appropriate tools. Ensure that they are within the specified torque/tension range to maintain the desired joint integrity.
4. **Corrosion Protection Inspection:**
    - Inspect any corrosion protection measures, such as coatings, inhibitors, or cathodic protection systems. Make sure they are still effective and not compromised.
5. **Environmental Factors:**
    - Consider the effects of environmental factors such as tidal forces, currents, and temperature fluctuations on the equipment and fasteners. Ensure that the equipment remains stable and secure.
6. **Bolt Stretch Measurement (if applicable):**
    - If bolt stretch measurement is used for critical fasteners, perform these measurements to ensure that the fasteners are maintaining the desired load.
7. **Documentation:**
    - Keep detailed records of all maintenance activities, including inspection dates, findings, repairs, torque/tension values, and any replacements made.
8. **Replacement and Repair:**
    - If fasteners are found to be damaged, corroded, or not within the specified torque/tension range, replace them with appropriate replacements. Repair any corrosion protection measures as needed.
9. **Lubrication and Anti-Seize Application:**
    - If applicable, reapply lubricants or anti-seize compounds to prevent galling and seizing during future maintenance or installation.
10. **Re-Certification (if required):**
    - In some industries or regulatory environments, subsea equipment may require periodic re-certification to ensure compliance with safety and

performance standards. Ensure that re-certification processes are followed as needed.

11. **Personnel Training:**
    - Ensure that the personnel responsible for subsea maintenance are trained and experienced in the proper procedures for working in subsea environments.
12. **Continuous Monitoring:**
    - Implement continuous monitoring systems where feasible to gather data about the performance of subsea equipment and detect any anomalies or deviations from expected conditions.

Remember that these procedures are general guidelines and should be tailored to the specific equipment and conditions of your subsea installation. Regular and thorough maintenance is essential to ensure the long-term reliability and safety of subsea fastener applications. Always consult industry standards, manufacturer guidelines, and relevant regulations when establishing your maintenance plan.

What safety issues are there to consider when securing fasteners on subsea applications?

Securing fasteners in subsea applications presents several safety challenges due to the harsh and often remote underwater environment. Safety is paramount to prevent equipment failure, protect personnel, and ensure the integrity of subsea structures. Here are some safety issues to consider when securing fasteners in subsea applications:

1. **Diving Hazards:**
    - If human divers are involved in the fastening process, there are risks associated with diving, including decompression sickness, nitrogen narcosis, and entanglement hazards. Proper training, safety protocols, and equipment are essential to mitigate these risks.

2. **Pressure and Depth Risks:**
   - Subsea environments experience high pressures at greater depths. Fasteners and equipment need to be designed and installed to withstand these pressures to prevent structural failure.
3. **Drowning and Entrapment:**
   - Personnel working in subsea environments are at risk of drowning or becoming trapped due to equipment malfunctions, entanglement, or disorientation. Adequate safety measures, such as proper communication systems and emergency procedures, are essential.
4. **Tool and Equipment Reliability:**
   - The reliability of tools and equipment used for subsea fastening is crucial. Malfunctioning tools or equipment failure can compromise the safety of personnel and the integrity of the installation.
5. **Environmental Conditions:**
   - Unpredictable weather, strong currents, and changing water conditions can pose risks to personnel and equipment. Monitoring weather forecasts and implementing contingency plans are important safety measures.
6. **Limited Visibility:**
   - Subsea environments often have limited visibility, making it difficult to assess risks and respond to emergencies. Proper lighting, communication, and navigation systems are vital to enhance visibility.
7. **Equipment Deployment and Retrieval:**
   - Deploying and retrieving subsea equipment can be hazardous due to the need for precision, coordination, and potential entanglement risks. Follow proper procedures and use appropriate lifting and handling equipment.
8. **Electrical Hazards:**
   - Electrical equipment used in subsea applications can pose risks of shock and electrocution. Implement proper insulation, grounding, and isolation measures to ensure electrical safety.

9. **Corrosion and Material Risks:**
   - Corrosion and material degradation can weaken fasteners and equipment over time. Regular inspections, maintenance, and the use of corrosion-resistant materials are essential to prevent failures.
10. **Emergency Response:**
    - Develop comprehensive emergency response plans that include procedures for medical emergencies, equipment failures, and personnel evacuation.
11. **Communication:**
    - Establish reliable communication systems for subsea operations to ensure constant contact with personnel and support teams on the surface.
12. **Regulatory Compliance:**
    - Subsea operations often have specific regulatory requirements that must be met to ensure safety. Adhering to these regulations is essential for maintaining a safe working environment.
13. **Training and Certification:**
    - Ensure that personnel involved in subsea fastening are properly trained, certified, and experienced in working in underwater environments.
14. **Contaminants and Pollutants:**
    - Subsea environments can contain pollutants or hazardous substances. Take measures to prevent contamination and ensure proper disposal of waste materials.
15. **Preventive Measures:**
    - Implement preventive measures such as risk assessments, hazard identification, and regular safety drills to prepare for potential emergencies.
16. **Remote Operation:**
    - If using remotely operated vehicles (ROVs) for fastening, ensure that the operators are skilled and trained in ROV operation and that the equipment is well-maintained.

Prioritizing safety through thorough planning, risk assessment, proper training, and adherence to industry best practices is essential to address the safety issues associated with securing fasteners in subsea applications.

THE RAILROAD INDUSTRY AND INDUSTRIAL FASTENERS

Industrial fasteners play a crucial role in the railroad industry, just as they do in many other industries. These fasteners are used to securely join various components and structures within railroad equipment, ensuring safety, reliability, and efficient operation. Here are some key roles that industrial fasteners play in the railroad industry:

1. **Track Fasteners:** Railroad tracks require a multitude of fasteners to hold rails and ties together. These fasteners include spikes, bolts, nuts, and washers. They are essential for maintaining track integrity, ensuring proper alignment, and preventing derailments.
2. **Structural Fasteners:** Trains and railway infrastructure, such as bridges, tunnels, and stations, rely on structural fasteners like bolts, rivets, and welds to hold together various components, including steel beams, support structures, and railcar frames. These fasteners must withstand heavy loads and harsh environmental conditions.
3. **Maintenance and Repair:** Industrial fasteners are used extensively in maintenance and repair activities. They secure components like brakes, couplings, and suspension systems to railcars and locomotives. When routine maintenance or repairs are needed, fasteners enable technicians to disassemble and reassemble parts efficiently.
4. **Safety and Reliability:** Fasteners play a critical role in ensuring the safety and reliability of railroad equipment. Properly fastened components reduce the risk of accidents and ensure that trains can operate smoothly and efficiently, carrying passengers and freight safely.
5. **Vibration Damping:** Railroads experience significant vibrations from passing trains. Specialized fasteners are designed to absorb and dampen these vibrations, reducing wear and tear on the track and equipment and extending their lifespan.
6. **Electrical and Electronic Components:** Fasteners secure electrical and electronic components on trains and railway infrastructure. This includes fastening wires, cables, signal equipment, and communication systems to ensure they remain in place and function reliably.
7. **Fastening Systems for Cargo:** In freight transportation, securing cargo is critical. Various fasteners like tie-down straps, bolts, and chains are used to secure cargo to railcars, ensuring that it remains in place during transit.

8. **Noise Reduction:** Fasteners may be used in noise reduction systems within railway equipment. They help fasten sound-dampening materials to reduce noise levels both inside and outside of trains.

In summary, industrial fasteners are essential components in the railroad industry, serving a wide range of purposes to ensure the safety, reliability, and efficiency of trains and railway infrastructure. They help maintain track integrity, secure structural components, facilitate maintenance and repair, and play a role in various other critical aspects of railroad operations.

What industrial fasteners are used on railroad locomotives and railcars of various types?

Railroad locomotives and railcars of various types use a wide range of industrial fasteners to secure, connect, and maintain various components and structures. The specific types of fasteners used can vary based on the design and purpose of the locomotive or railcar. Here are some common industrial fasteners used in the railroad industry:

1. **Bolts and Nuts:** Bolts and nuts are used throughout locomotives and railcars to secure various components. They can be found in wheel assemblies, suspension systems, couplers, and other critical areas.
2. **Screws:** Screws are used in applications where a threaded fastener is needed to hold components together. They can be found in electrical and electronic systems, among other places.
3. **Rivets:** Rivets are used for permanent fastening of components in situations where welding or other methods are not practical. They are commonly used in railcar construction, especially for joining sheet metal.
4. **Cotter Pins:** Cotter pins are used to secure nuts or other fasteners in place, preventing them from loosening due to vibration or other forces.
5. **Clevis Pins:** Clevis pins are used in linkage systems for various purposes, such as connecting brake components or actuating mechanisms.
6. **Clamps:** Clamps are used to secure hoses, pipes, and cables in place, preventing them from moving or coming loose during operation.
7. **Washers:** Washers are used in conjunction with bolts and nuts to distribute loads and prevent damage to the connected materials.

8. **Hitch Pins:** Hitch pins are used to secure couplers and drawbars, ensuring a safe connection between railcars.
9. **Retaining Rings:** Retaining rings are used to secure bearings and other components on axles and shafts.
10. **Threaded Inserts:** Threaded inserts are used in situations where threads need to be added to a component or structure, allowing for the attachment of fasteners.
11. **Weld Studs:** Weld studs are used in welding applications to provide a threaded or anchored point for fasteners.
12. **Spring Pins:** Spring pins, also known as roll pins, are used in a variety of applications to secure components, such as brake components and hitches.
13. **Tie-down Straps and Fasteners:** In freight rail transportation, various tie-down straps, hooks, and fasteners are used to secure cargo in place within railcars.
14. **Expansion Bolts:** Expansion bolts are used to secure components to concrete or masonry surfaces, often found in rail station and infrastructure construction.
15. **Specialized Fasteners:** Depending on the specific needs of the locomotive or railcar, specialized fasteners designed for high-stress or critical applications may be used.

It's important to note that railroad fasteners must meet stringent quality and safety standards to ensure the reliability and safety of rail operations. These standards can vary by region and are often regulated by industry organizations such as the American Railway Engineering and Maintenance-of-Way Association (AREMA) in the United States. Manufacturers and rail operators must ensure that the fasteners they use comply with these standards to maintain the integrity of the rail system.

What procedures and practices should be carried out when using industrial fasteners for the above applications in the railroad industry?

Using industrial fasteners in the railroad industry requires strict adherence to procedures and practices to ensure safety, reliability, and compliance with industry standards. Here are some key procedures and practices that should be carried out:

1. **Design and Engineering:** Ensure that fasteners are selected and designed according to the specific requirements of the application. Factors to consider include load capacity, vibration resistance, corrosion resistance, and compatibility with the materials being fastened.
2. **Inspection and Quality Control:** Implement stringent quality control procedures to inspect and test fasteners before use. This includes checking for defects, proper threading, and material composition. Only use fasteners that meet industry standards and specifications.
3. **Torque Control:** Follow recommended torque values and tightening procedures to ensure that fasteners are correctly and uniformly tightened. Over-tightening or under-tightening can lead to failures.
4. **Fastener Lubrication:** Apply appropriate lubrication to threaded fasteners to reduce friction during installation and prevent galling or seizing.
5. **Thread Protection:** Protect threads from contamination, rust, and corrosion, especially in outdoor or exposed environments. Threaded fasteners should be covered with appropriate protective coatings or compounds.
6. **Proper Installation Tools:** Use calibrated and properly maintained tools, such as torque wrenches, to achieve accurate and consistent torque values. Avoid using impact wrenches for critical fasteners as they can cause over-tightening.
7. **Training and Certification:** Ensure that personnel involved in fastener installation and maintenance receive proper training and certification. They should be familiar with the specific fasteners and procedures relevant to their roles.
8. **Documentation:** Maintain records of fastener installations, torque values, inspections, and any replacements. This documentation is essential for tracking maintenance and ensuring compliance with industry regulations.

9. **Regular Inspections:** Implement a routine inspection schedule to check the condition of fasteners, particularly in critical areas like track fasteners. Inspect for signs of wear, damage, or corrosion, and replace fasteners as needed.
10. **Corrosion Prevention:** Utilize corrosion-resistant fasteners, coatings, or cathodic protection systems in areas where fasteners are exposed to harsh environmental conditions, such as moisture and chemicals.
11. **Safety Procedures:** Prioritize safety when working with fasteners. Follow appropriate safety protocols, including wearing personal protective equipment (PPE) and using fall protection equipment when working at heights.
12. **Environmental Considerations:** Dispose of old or damaged fasteners responsibly, following environmental regulations and guidelines for recycling or disposal.
13. **Industry Standards:** Stay up-to-date with relevant industry standards and guidelines, such as those provided by organizations like the American Railway Engineering and Maintenance-of-Way Association (AREMA) or international standards bodies.
14. **Supplier and Material Traceability:** Maintain traceability of fasteners and their sources to ensure that they meet required standards and specifications. This is crucial for quality control and warranty purposes.

By adhering to these procedures and practices, the railroad industry can ensure the proper use of industrial fasteners, enhance safety, and extend the lifespan of equipment and infrastructure. Compliance with industry standards and ongoing maintenance efforts are essential for the safe and efficient operation of railroads.

What safety considerations must be strictly adhered to when using industrial fasteners in the railroad industry?

Safety is of paramount importance when using industrial fasteners in the railroad industry. Strict adherence to safety considerations is crucial to prevent accidents, injuries, and equipment failures. Here are some key safety considerations that must be followed:

1. **Personal Protective Equipment (PPE):** Workers should wear appropriate PPE, including safety glasses, gloves, helmets, and steel-toed boots, when working with fasteners. The specific PPE requirements may vary depending on the job and location.

2. **Fall Protection:** When working at heights, such as on bridges or elevated railway structures, use fall protection equipment like harnesses and lanyards. Ensure proper training and compliance with fall protection procedures and regulations.
3. **Tool Safety:** Ensure that all tools, including torque wrenches and other fastening equipment, are in good working condition and properly calibrated. Train personnel on the safe use of tools to prevent injuries and over-tightening of fasteners.
4. **Lifting and Handling:** Use proper lifting techniques and equipment, such as cranes or hoists, when handling heavy or large fasteners. Avoid manual lifting when it could lead to strain or injury.
5. **Environmental Hazards:** Be aware of environmental hazards, such as wet or slippery surfaces, extreme temperatures, or hazardous materials, which can pose additional risks during fastener installation or maintenance.
6. **Fire Safety:** In areas with potential fire hazards, take precautions to prevent sparks or open flames near flammable materials. Use non-sparking tools where necessary.
7. **Lockout/Tagout (LOTO):** When working on equipment that requires fastener removal, implement proper lockout/tagout procedures to isolate and de-energize the equipment. This prevents accidental start-ups and associated hazards.
8. **Traffic Control:** If fastener work is performed near active railroad tracks, implement traffic control measures to protect workers from oncoming trains. Workers should be well-versed in railway safety protocols.
9. **Hazard Communication:** Ensure that workers are informed about any potential hazards associated with the materials or fasteners they are handling. Proper labeling and communication are essential.
10. **Emergency Response:** Establish clear emergency response procedures and ensure that all workers are trained in first aid and know the location of emergency equipment, such as fire extinguishers and eyewash stations.
11. **Material Handling:** Properly store and handle fasteners to prevent injuries caused by falling or shifting materials. Follow guidelines for stacking, storage, and transport of fasteners.
12. **Corrosion Control:** Be aware of the potential for corrosion on fasteners in outdoor or corrosive environments. Use appropriate corrosion-resistant materials and regularly inspect and maintain fasteners.
13. **Documentation:** Keep records of safety training, inspections, and incidents. This documentation is essential for compliance and continuous improvement in safety practices.

14. **Compliance with Regulations:** Ensure that all safety practices and procedures adhere to local, state, and federal regulations, as well as industry-specific standards and guidelines.
15. **Safety Training:** Provide comprehensive safety training to all personnel involved in fastener-related tasks. This training should cover not only fastener-specific safety but also general railway safety practices.

Safety should always be the top priority in the railroad industry when working with industrial fasteners. A culture of safety, ongoing training, and strict adherence to safety procedures are critical to minimizing risks and ensuring the well-being of workers and the reliability of railway equipment.

What could be the repercussions if the safety guidelines are not followed in the railroad industry?

Failure to follow safety guidelines and practices in the railroad industry can have serious and far-reaching repercussions. These repercussions can impact various aspects of the industry, including human safety, operational efficiency, legal consequences, and public perception. Here are some potential repercussions of not adhering to safety guidelines:

1. **Accidents and Injuries:** The most immediate and severe consequence of not following safety guidelines is the increased risk of accidents and injuries. This includes not only workers but also passengers, pedestrians, and anyone in the vicinity of railroad operations. Accidents can result in severe injuries, disabilities, or even fatalities.
2. **Equipment Failures:** Safety procedures are in place to ensure the proper maintenance and operation of railroad equipment. Neglecting these procedures can lead to equipment failures, breakdowns, and costly repairs. This can disrupt rail services and lead to delays and financial losses.
3. **Environmental Damage:** Accidents involving hazardous materials or fuel spills can lead to environmental contamination and damage. Cleanup efforts can be expensive, and the company may be held responsible for environmental restoration.
4. **Regulatory Penalties:** Regulatory agencies such as the Federal Railroad Administration (FRA) in the United States have strict safety regulations. Non-

compliance can result in fines, penalties, and legal actions against the railroad company.

5. **Lawsuits:** Injured parties or their families may file lawsuits against the railroad company for negligence if safety guidelines are not followed, leading to accidents or injuries. Legal battles can be costly and damage a company's reputation.
6. **Reputation Damage:** Safety incidents and accidents can tarnish a railroad company's reputation, eroding public trust and confidence. This can lead to a loss of customers and a negative impact on the company's brand image.
7. **Increased Insurance Costs:** Frequent safety violations and accidents can lead to higher insurance premiums, increasing the overall operational costs of the railroad company.
8. **Operational Disruption:** Accidents and equipment failures can disrupt rail services, leading to delays, cancellations, and financial losses. This can affect not only the company but also its customers and the broader economy.
9. **Increased Oversight:** Regulatory authorities may increase their oversight and audits of the railroad company if safety violations are detected. This can lead to additional administrative burdens and potential fines.
10. **Loss of Licenses or Permits:** Serious and repeated safety violations can result in the suspension or revocation of licenses or permits necessary to operate a railroad, effectively shutting down operations.
11. **Loss of Human Capital:** Injuries or fatalities among employees can result in the loss of skilled workers, negatively impacting workforce morale and efficiency.
12. **Public Outcry:** High-profile safety incidents can lead to public outcry and calls for stricter regulations, potentially impacting the industry as a whole.

To avoid these repercussions, railroad companies must prioritize safety, invest in training and equipment, and establish a strong safety culture. By doing so, they can protect the well-being of their employees, passengers, and the general public while ensuring the reliable and efficient operation of their services.

WASTEWATER TREATMENT PLANT FASTENERS

A wastewater treatment plant is a complex facility designed to treat and purify wastewater before it's released back into the environment. The specific composition of equipment required can vary depending on the scale of the plant, the treatment processes used, and the local regulations. However, I can provide a general overview of the common equipment you might find in a wastewater treatment plant:

1. **Preliminary Treatment Equipment:**
   - Bar Screens: Removes large debris and solids.
   - Grit Chambers: Settles heavy particles like sand and gravel.
   - Communitors: Shreds larger solids into smaller pieces.
2. **Primary Treatment Equipment:**
   - Primary Settling Tanks (Clarifiers): Allows heavier solids to settle at the bottom, forming primary sludge.
3. **Secondary Treatment Equipment:**
   - Aeration Tanks: Provide oxygen to promote the growth of aerobic microorganisms that break down organic matter.
   - Secondary Settling Tanks (Secondary Clarifiers): Settles the biological flocs (biomass) formed during the secondary treatment process.
4. **Tertiary Treatment Equipment:**
   - Tertiary Filters: Further removes fine solids, suspended matter, and nutrients (such as phosphorus) through sand or multimedia filters.
   - Disinfection Units: Common methods include chlorination, ultraviolet (UV) disinfection, and ozonation to kill pathogens.
5. **Sludge Treatment Equipment:**
   - Sludge Thickening Equipment: Thickens the primary and secondary sludges to reduce the volume.
   - Sludge Digesters: Biological processes that break down organic matter in sludge and produce biogas (methane).

- Sludge Dewatering Equipment: Removes water from digested sludge, reducing its volume for disposal or further treatment.

6. **Chemical Treatment Equipment:**
    - Chemical Addition Systems: Used for pH adjustment, coagulation, flocculation, and phosphorus removal.
7. **Monitoring and Control Systems:**
    - SCADA (Supervisory Control and Data Acquisition): Centralized control system for monitoring and controlling various processes.
    - Instrumentation: Sensors and meters to measure parameters like pH, dissolved oxygen, turbidity, and flow rates.
8. **Support Infrastructure:**
    - Pumps: Move wastewater through various treatment stages.
    - Pipes and Conduits: Transport wastewater within the plant.
    - Storage Tanks: Store chemicals, treated water, and sludge.
    - Energy Generation Equipment: Some plants utilize biogas produced during sludge digestion to generate electricity.
9. **Safety and Environmental Protection:**
    - Odor Control Systems: Minimize unpleasant odors emitted from the treatment process.
    - Containment Measures: Prevent accidental spills and leaks into the environment.

Remember, the specific equipment and processes can vary based on the treatment level the plant aims to achieve (primary, secondary, or tertiary), the type of wastewater being treated (industrial or municipal), and the local regulations governing water quality and environmental protection.

From the overview of the equipment commonly found in a wastewater treatment plant, what type and size of fasteners are needed for the equipment?

The type and size of fasteners required for equipment in a wastewater treatment plant can vary depending on factors such as the specific equipment, its materials, the environment (including exposure to water and chemicals), and the loads it will experience. Here are some common types of fasteners and considerations for their selection:

1. **Bolts and Nuts:**
   - Stainless steel bolts and nuts are often preferred due to their corrosion resistance, especially in a water-rich and potentially chemically aggressive environment.
   - The size and strength (specified by bolt grade) of bolts and nuts depend on the loads the equipment will experience. Common grades include A2-70, A4-70, and A4-80 stainless steel.
2. **Screws:**
   - Stainless steel screws are used for attaching various components and smaller parts.
   - Self-tapping screws might be used for securing panels or covers.
3. **Washers:**
   - Stainless steel washers are used to distribute loads and prevent damage to the equipment's surfaces.
   - Flat washers, lock washers, and spring washers might be used depending on the application.
4. **Anchors:**
   - Concrete anchors are necessary for securing equipment to concrete surfaces. Expansion anchors and epoxy anchors are common types.
   - For corrosive environments, consider stainless steel anchors.
5. **Clamps and Straps:**
   - Stainless steel hose clamps are used to secure hoses and pipes.
   - Pipe straps might be used to secure pipes and conduits to walls or supports.
6. **Threaded Inserts:**
   - Threaded inserts can provide durable threaded connections in materials that might not have sufficient strength for direct threading.

7. **Corrosion Resistance:**
   - Given the moisture and potentially corrosive environment, using fasteners made from corrosion-resistant materials like stainless steel (such as 304 or 316 grades) is highly recommended.
8. **Size and Load Capacity:**
   - The size and strength of the fasteners should match the load requirements of the equipment. Consult engineering specifications and load calculations to determine the appropriate size and type of fasteners.
9. **Vibration and Movement:**
   - For equipment subject to vibrations or movement, consider using locking mechanisms like nylon-insert nuts, prevailing torque nuts, or thread-locking compounds.
10. **Chemical Resistance:**
    - If the equipment will be exposed to chemicals used in the treatment process, ensure the fasteners are resistant to those chemicals to prevent degradation.

It's crucial to consult with engineers, equipment manufacturers, and possibly a structural engineer to determine the precise types and sizes of fasteners needed for each specific piece of equipment. They can provide recommendations based on load calculations, material compatibility, and the environmental conditions of the wastewater treatment plant.

What water pressures are found in a wastewater treatment plant and what fasteners are necessary to secure the equipment used?

Water pressures in a wastewater treatment plant can vary widely depending on the specific processes, equipment, and design considerations. The water pressure at different points within the plant might range from very low to moderate levels. Here are some general guidelines for water pressure ranges in different areas of a wastewater treatment plant:

1. **Low Pressure Areas:**
    - Preliminary Treatment: In areas like bar screens and grit chambers, water pressure is typically low to moderate, as water is being used for basic cleaning and separation.
    - Piping and Conduits: The pressure in pipes that transport wastewater within the plant might be low, especially in gravity-based systems.
2. **Moderate Pressure Areas:**
    - Aeration Tanks: Moderate water pressures might be present due to the aeration process that introduces air into the tanks.
    - Disinfection Units: Pressure can vary depending on the type of disinfection used, such as UV systems that might require a certain water pressure to operate effectively.
3. **Considerations for Fasteners:**
    - In low to moderate pressure areas, standard stainless steel fasteners (bolts, nuts, screws, etc.) with appropriate corrosion resistance (304 or 316 stainless steel) are often sufficient.
    - Fasteners should be chosen based on load calculations, material compatibility, and environmental factors, rather than primarily considering water pressure.
4. **Special Considerations:**
    - If there are specific areas where water pressure is significantly higher (e.g., due to pumps or pressurized systems), you might need to consider factors like vibration, movement, and potential stress on fasteners.
5. **Vibration and Movement:**
    - In areas where equipment experiences vibration or movement, consider using fasteners designed to handle such conditions. Locking nuts, lock washers, or thread-locking compounds can be useful to prevent fasteners from loosening.
6. **Chemical Exposure:**
    - If equipment is exposed to chemicals used in the treatment process, ensure the fasteners are resistant to those chemicals to prevent degradation.

Remember that the water pressure itself might not be the primary factor determining the choice of fasteners. Other factors, such as the mechanical loads the equipment experiences, the material properties of the equipment, and the environmental conditions (corrosion, chemical exposure), play a significant role in selecting the appropriate fasteners.

It's crucial to work with engineers and possibly consult the equipment manufacturer to determine the specific requirements for securing equipment in a wastewater treatment plant. They can provide guidance based on the equipment's design, load calculations, and the conditions it will be exposed to.

What safety considerations must be in place in a wastewater treatment plant involving the fasteners used?

Safety is of paramount importance in a wastewater treatment plant to protect personnel, the environment, and the integrity of the facility. When it comes to fasteners used in the plant, several safety considerations should be in place:

1. **Corrosion Resistance and Material Selection:**
    - Use corrosion-resistant materials, such as stainless steel (304 or 316 grades), for fasteners to prevent degradation over time due to exposure to water, chemicals, and environmental factors.
2. **Load-Bearing Capacity:**
    - Ensure that fasteners are appropriately sized and have the required load-bearing capacity to support the equipment or components they secure. Incorrectly sized fasteners can lead to failures and potentially dangerous situations.
3. **Proper Installation:**
    - Fasteners should be installed according to manufacturer guidelines and engineering specifications to ensure their effectiveness and safety.
    - Over-tightening or under-tightening fasteners can lead to issues such as material deformation, thread damage, or joint failure.
4. **Vibration and Movement:**

- In areas where equipment experiences vibration or movement, use appropriate fasteners that are resistant to loosening. This prevents the risk of fasteners coming undone and causing equipment instability.

5. **Inspection and Maintenance:**
   - Regularly inspect fasteners for signs of corrosion, wear, or damage. Replace any fasteners that show signs of deterioration to prevent potential failures.
   - Include fasteners in routine maintenance schedules to ensure their integrity over time.
6. **Chemical Exposure:**
   - If fasteners are exposed to chemicals used in the treatment process, ensure they are chemically resistant to avoid weakening or degradation.
7. **Fall Protection:**
   - In areas where maintenance or inspection of elevated equipment is required, implement fall protection measures to prevent personnel from falling and potentially getting injured.
8. **Locking Mechanisms:**
   - In areas prone to vibration, use locking mechanisms such as locking nuts, lock washers, or thread-locking compounds to prevent fasteners from loosening.
9. **Environmental Considerations:**
   - Consider the environmental conditions of the plant, including temperature variations, humidity, and exposure to harsh elements, when selecting fasteners.
10. **Documentation and Record-Keeping:**
    - Maintain records of the fasteners used, their specifications, installation dates, and maintenance history. This information can be crucial for traceability and identifying potential issues.
11. **Training and Awareness:**
    - Provide training to personnel about the importance of proper fastener installation, maintenance, and safety precautions.
    - Ensure that personnel are aware of potential hazards associated with fasteners and understand how to handle them safely.

Safety is a collaborative effort involving engineers, maintenance teams, and management. Regular risk assessments and continuous improvement efforts can help create a safer working environment in a wastewater treatment plant involving the use of fasteners.

What procedures should be used in doing maintenance in a wastewater treatment plant?

Maintenance in a wastewater treatment plant is critical for ensuring the efficient and safe operation of the facility. Proper maintenance procedures help prevent equipment failures, optimize processes, and extend the lifespan of equipment. Here are key steps and procedures to follow when conducting maintenance in a wastewater treatment plant:

1. **Develop a Maintenance Plan:**
   - Create a comprehensive maintenance plan that outlines the types of maintenance tasks needed, their frequency, and responsible personnel.
   - Identify critical equipment and prioritize maintenance tasks based on importance and potential impact on operations.
2. **Routine Inspections:**
   - Regularly inspect equipment and components for signs of wear, corrosion, leaks, and other issues.
   - Use checklists to ensure that all relevant components are inspected systematically.
3. **Preventive Maintenance:**
   - Schedule preventive maintenance tasks such as lubrication, calibration, and routine adjustments to keep equipment in optimal condition.
   - Follow manufacturer guidelines for recommended maintenance intervals and procedures.
4. **Corrective Maintenance:**
   - Address equipment failures and issues promptly to minimize downtime. Document the problems, repairs made, and any replacement parts used.

5. **Predictive Maintenance:**
    - Utilize predictive technologies (vibration analysis, thermography, oil analysis) to identify potential issues before they lead to failures.
6. **Shutdown Planning:**
    - Coordinate maintenance activities with plant operations to minimize disruption.
    - Plan and schedule maintenance during planned shutdowns or low-demand periods.
7. **Lockout/Tagout Procedures:**
    - Follow proper lockout/tagout procedures when working on equipment to prevent accidental startup and ensure the safety of maintenance personnel.
8. **Documentation:**
    - Maintain detailed records of maintenance activities, including dates, tasks performed, parts replaced, and any issues encountered.
    - Use digital tools or maintenance management software for efficient record-keeping.
9. **Training and Skill Development:**
    - Ensure that maintenance personnel are properly trained in equipment operation, maintenance procedures, and safety protocols.
    - Encourage continuous learning and skill development to stay up-to-date with new technologies and practices.
10. **Spare Parts Inventory:**
    - Maintain an inventory of critical spare parts to minimize downtime. Regularly review and replenish the inventory as needed.
11. **Environmental Considerations:**
    - Adhere to environmental regulations when handling hazardous materials, chemicals, and waste generated during maintenance activities.
12. **Communication:**
    - Foster effective communication between maintenance teams, operators, and management to ensure everyone is informed about maintenance schedules and activities.
13. **Emergency Response Planning:**

- Have clear procedures in place for handling emergencies that might arise during maintenance activities, such as chemical spills or equipment malfunctions.

14. **Continuous Improvement:**

- Regularly review maintenance processes and outcomes to identify areas for improvement. Use data from inspections and breakdowns to refine maintenance strategies.

Remember that maintenance procedures may vary based on the specific equipment, processes, and regulations in your wastewater treatment plant. Developing a comprehensive and well-documented maintenance strategy tailored to your plant's needs is crucial for safe and efficient operations.

WIND TOWER FASTENERS AND MAINTENANCE

The construction of wind towers typically involves the use of various types of fasteners to securely join different components together. The specific types of fasteners used can vary depending on the design of the tower, the materials being used, and the engineering requirements. Some common types of fasteners used in the construction of wind towers include:

1. **Bolts:** Bolts are commonly used fasteners in wind tower construction. High-strength bolts are often used to connect tower sections together, such as the flanges of tower segments. These bolts are usually made of steel and are designed to withstand the forces and stresses that wind towers experience.
2. **Nuts:** Nuts are paired with bolts to secure them in place. They come in various sizes and strengths, and they play a crucial role in maintaining the integrity of the connections.
3. **Washers:** Washers are used in conjunction with bolts and nuts. They help distribute the load evenly over the surface area and prevent damage to the connected materials.
4. **Anchor Bolts:** Anchor bolts are used to secure the wind tower's base to its foundation. They are embedded in concrete and provide stability and support to the tower structure.
5. **Flange Bolts:** Flange bolts are used to connect flanged components, such as tower sections or turbine components. They have a larger flange-like head that provides a wider contact area.
6. **Hex Head Bolts:** These bolts have a hexagonal head and are used in various applications within wind tower construction.
7. **Socket Head Cap Screws:** These screws have a cylindrical head with a hexagonal socket, allowing for easy tightening with a hex key (Allen wrench). They are often used in situations where space is limited.
8. **Threaded Rods:** Threaded rods are used in applications where a long continuous fastener is required. They are often cut to size and used to secure components together.

9. **Stud Bolts:** Stud bolts are threaded rods with threads on both ends. They are used to connect flanges in a bolted joint.
10. **Locking Fasteners:** Various types of locking mechanisms, such as lock washers, nylon-insert nuts, or thread-locking compounds, can be used to prevent loosening of fasteners due to vibrations or other factors.
11. **Cotter Pins and R-Clips:** These fasteners are used for securing parts that require periodic maintenance, such as access panels or covers.
12. **Grout:** While not a traditional fastener, grout is often used in wind tower construction to fill gaps and provide additional stability and load distribution, especially in the base connections.

It's important to note that wind tower construction is a specialized field, and the choice of fasteners depends on factors such as tower design, materials used, environmental conditions, and regulatory requirements. Engineers and construction professionals typically ensure that the chosen fasteners meet the required strength and durability standards for the specific wind tower project.

What is the difference in fasteners used in onshore and offshore wind towers?

The fasteners used in onshore and offshore wind towers share many similarities, but there are also some differences due to the unique challenges and conditions presented by offshore environments. Here are some of the key differences in the fasteners used in onshore and offshore wind towers:

1. **Corrosion Resistance:** Offshore wind towers are exposed to more corrosive conditions due to the presence of saltwater, humidity, and harsh weather. Fasteners used in offshore applications often need to have enhanced corrosion resistance to ensure the structural integrity of the tower over its lifespan. This may involve using materials like stainless steel, corrosion-resistant coatings, or other specialized treatments.
2. **Materials:** In general, offshore wind towers may require more advanced and corrosion-resistant materials for their fasteners. This could include stainless

steel grades like Duplex or Super Duplex, which offer high corrosion resistance and mechanical strength. Onshore wind towers might use standard high-strength steel fasteners.

3. **Tightening Methods:** Offshore wind towers often use torque control or tension control methods for fastener tightening. These methods ensure that fasteners are properly tightened to specified levels, minimizing the risk of under- or over-tightening, which can be critical for maintaining the tower's structural integrity.
4. **Ease of Maintenance:** Offshore wind towers are more challenging to access for maintenance and repair compared to onshore towers. This can influence the choice of fasteners to make sure they are durable and reliable over extended periods without frequent maintenance.
5. **Vibration and Fatigue:** Offshore wind towers can experience higher levels of vibration and fatigue due to waves, wind, and other environmental factors. Fasteners used in offshore applications need to be designed to withstand these dynamic forces to prevent loosening or failure over time.
6. **Load and Stress Considerations:** Offshore wind towers often need to withstand more severe loading conditions than onshore towers due to the harsh marine environment. Fasteners used offshore must be selected to handle the increased stresses and loads, particularly in critical joints and connections.
7. **Ease of Installation:** Offshore wind towers are constructed in more challenging conditions than onshore towers, often requiring specialized installation equipment and procedures. Fasteners used offshore might need to accommodate these unique installation methods.
8. **Environmental Regulations:** Offshore wind projects are subject to specific environmental regulations to minimize their impact on marine ecosystems. This could influence the choice of fasteners and coatings to ensure they meet these environmental standards.

In summary, the main differences in fasteners used in onshore and offshore wind towers lie in their corrosion resistance, materials, tightening methods, durability, load-bearing capacities, and considerations for unique environmental conditions.

These differences are aimed at ensuring the safety, integrity, and longevity of wind towers in their respective environments.

What are the maintenance procedures for fasteners used in onshore wind towers?

Maintenance procedures for fasteners used in onshore wind towers are essential to ensure the structural integrity and safety of the tower throughout its operational life. Proper maintenance helps prevent loosening, corrosion, fatigue, and other issues that can arise due to environmental conditions and mechanical stresses. Here are some key maintenance procedures for fasteners in onshore wind towers:

1. **Regular Inspection:** Perform routine visual inspections of fasteners to identify signs of corrosion, wear, or damage. Inspections can be part of scheduled maintenance checks.
2. **Torque Checks:** Regularly check and, if necessary, retorque critical fasteners to ensure they are properly tightened. Over time, vibrations and external forces can cause fasteners to become loose, compromising the integrity of the tower.
3. **Corrosion Protection:** Apply corrosion-resistant coatings or treatments to fasteners as needed. Corrosion can weaken fasteners and compromise their load-bearing capacity.
4. **Replacement:** Replace fasteners that show signs of excessive wear, corrosion, or damage. Use high-quality replacement fasteners that meet the original design specifications.
5. **Fatigue Analysis:** Conduct periodic fatigue analysis on critical fastener connections to assess their durability under changing loads and conditions. This analysis helps identify potential fatigue-related failures.
6. **Thread Cleaning:** Regularly clean threaded fasteners to remove dirt, debris, and contaminants that can hinder proper tightening or cause corrosion.

7. **Documentation:** Maintain a record of all maintenance activities related to fasteners. This documentation helps track the history of maintenance, replacements, and any issues that arise.
8. **Tightening Methods:** Follow recommended torque or tension control procedures when tightening fasteners during maintenance or installation. Proper tightening ensures consistent and accurate clamping force.
9. **Locking Mechanisms:** Check and replace locking mechanisms such as lock washers, self-locking nuts, or thread-locking compounds as needed to prevent fastener loosening due to vibrations.
10. **Access Panels:** If the tower has access panels or covers, ensure they are properly secured and maintained. Fasteners used for these panels should be periodically checked.
11. **Environmental Factors:** Consider the local climate and environmental conditions when determining the maintenance frequency. Areas with high humidity, salt exposure, or extreme weather may require more frequent inspections and maintenance.
12. **Training:** Ensure maintenance personnel are properly trained in fastener maintenance procedures, including torque techniques, inspection methods, and proper usage of tools.
13. **Record Keeping:** Keep detailed records of all maintenance activities, including inspection dates, torque values used, replacement dates, and any issues encountered. This historical data can help identify patterns and make informed decisions for future maintenance.
14. **Preventive Maintenance:** Implement a proactive maintenance schedule to prevent issues before they escalate. Regular inspections and maintenance can extend the lifespan of fasteners and the overall wind tower structure.

Remember that maintenance procedures may vary based on the specific design, materials, and environmental conditions of the wind tower. It's essential to follow the manufacturer's recommendations and industry best practices to ensure the safety and longevity of the tower and its fasteners.

What are the maintenance procedures for fasteners used in offshore wind towers?

Maintenance procedures for fasteners used in offshore wind towers are crucial to ensure the integrity and reliability of the tower structures in the harsh marine environment. The challenging conditions offshore, including saltwater exposure, high winds, and waves, make proper maintenance even more essential. Here are some key maintenance procedures for fasteners in offshore wind towers:

1. **Regular Inspection:** Conduct routine visual inspections of fasteners to identify signs of corrosion, wear, or damage. Inspections can be part of scheduled maintenance checks, and remote inspection technologies may be employed for hard-to-reach areas.
2. **Corrosion Protection:** Apply specialized corrosion-resistant coatings, such as marine-grade coatings or cathodic protection systems, to fasteners to mitigate the effects of saltwater exposure and prevent corrosion.
3. **Tightening Checks:** Regularly check and retighten critical fasteners as needed. The dynamic offshore environment can cause fasteners to loosen over time due to vibrations and forces.
4. **Subsea Inspections:** For underwater connections and fasteners, implement underwater inspection techniques using remotely operated vehicles (ROVs) or other subsea inspection tools to assess their condition.
5. **Replacement:** Replace fasteners that show signs of excessive wear, corrosion, or damage with high-quality replacements that are designed for offshore conditions.
6. **Thread Cleaning:** Ensure threaded fasteners are clean and free from debris or marine growth that could impact proper tightening.
7. **Locking Mechanisms:** Verify the functionality of locking mechanisms like lock washers, self-locking nuts, or thread-locking compounds to prevent fastener loosening caused by vibrations.
8. **Fatigue Analysis:** Periodically perform fatigue analysis on critical fastener connections to assess their durability under varying loads and harsh environmental conditions.

9. **Environmental Monitoring:** Utilize environmental monitoring systems to track conditions such as seawater temperature, salinity, and wave intensity, which can impact fastener corrosion rates.
10. **Access and Safety:** Ensure safe access for maintenance personnel by providing appropriate safety equipment and procedures, especially considering the challenging offshore environment.
11. **Documentation:** Maintain detailed records of all maintenance activities related to fasteners, including inspection dates, torque values used, replacement dates, and any issues encountered.
12. **Preventive Maintenance:** Implement a proactive maintenance schedule that considers the unique challenges of the offshore environment. Regular inspections and maintenance can prevent issues before they escalate.
13. **Emergency Procedures:** Develop and communicate emergency maintenance procedures to address unexpected issues, such as sudden fastener failures or unexpected environmental conditions.
14. **Personnel Training:** Ensure maintenance personnel are well-trained in offshore maintenance procedures, including safety protocols, corrosion prevention techniques, and proper use of specialized tools.
15. **Collaboration:** Collaborate with offshore experts and professionals who have experience in offshore maintenance to ensure best practices are followed.
16. **Remote Monitoring:** Consider implementing remote monitoring systems that allow real-time tracking of fastener conditions and integrity, reducing the need for frequent physical inspections.

Due to the demanding nature of the offshore environment, maintenance of fasteners in offshore wind towers requires thorough planning, specialized tools, and a deep understanding of the unique challenges presented by the marine environment. Following manufacturer recommendations, industry standards, and best practices is essential to ensure the safety and reliability of offshore wind tower structures.

What safety considerations are there involving securing fasteners on both onshore and offshore wind tower applications?

Securing fasteners on both onshore and offshore wind tower applications involves several critical safety considerations to ensure the integrity, reliability, and safety of the tower structures. The following are some key safety considerations that apply to both environments:

1. **Proper Torque:** Properly tightening fasteners to the specified torque is crucial. Under-tightened fasteners can lead to structural instability, while over-tightened fasteners can cause damage or failure. Following manufacturer guidelines for torque values and using calibrated torque wrenches are essential.
2. **Quality Control:** Use high-quality fasteners that meet industry standards and are designed for the specific application. Substandard or counterfeit fasteners can compromise the structural integrity of the tower.
3. **Corrosion Prevention:** Implement corrosion prevention measures to protect fasteners from environmental elements. This is especially critical in offshore environments where saltwater exposure can accelerate corrosion.
4. **Locking Mechanisms:** Employ appropriate locking mechanisms, such as lock washers, self-locking nuts, or thread-locking compounds, to prevent fastener loosening due to vibrations and dynamic loads.
5. **Inspection:** Regularly inspect fasteners for signs of corrosion, wear, or damage. Promptly address any issues identified during inspections.
6. **Proper Installation:** Follow recommended installation procedures, including tightening sequences and methods, to ensure even distribution of clamping forces across joints.
7. **Thread Integrity:** Ensure the integrity of threaded connections by using clean threads and avoiding cross-threading, which can weaken the fastener's holding capacity.
8. **Access and Fall Protection:** Provide proper access platforms, ladders, and fall protection systems for maintenance personnel working at height. Safety measures are crucial to prevent falls and accidents during maintenance tasks.

9. **Emergency Procedures:** Develop clear emergency procedures for addressing unexpected fastener failures or other structural issues that may arise during tower operation.
10. **Personnel Training:** Ensure that maintenance personnel are properly trained in fastener maintenance procedures, tower safety protocols, and proper use of equipment. Training helps prevent errors that can compromise safety.
11. **Environmental Conditions:** Consider the effects of environmental conditions, such as wind, rain, or ice, on maintenance tasks involving fasteners. Work should be planned and executed safely, considering weather conditions.
12. **Equipment Inspection:** Regularly inspect and maintain the tools and equipment used for fastener maintenance to ensure their proper functioning and safety.
13. **Personal Protective Equipment (PPE):** Provide appropriate PPE, including helmets, safety glasses, gloves, and harnesses, to protect maintenance personnel from potential hazards.
14. **Record Keeping:** Maintain comprehensive records of all maintenance activities, inspections, torque values, replacements, and issues encountered. These records aid in tracking the history of maintenance and identifying patterns.
15. **Collaboration and Communication:** Foster clear communication and collaboration among maintenance teams, engineers, and project managers to address safety concerns effectively.
16. **Risk Assessment:** Conduct thorough risk assessments before any maintenance work involving fasteners to identify potential hazards and implement appropriate mitigation strategies.
17. **Regulatory Compliance:** Ensure that all maintenance activities adhere to relevant safety regulations and industry standards.

Both onshore and offshore wind tower applications require rigorous safety protocols to protect personnel, maintain the structural integrity of the tower, and ensure the long-term performance of the wind energy infrastructure. Safety considerations should be integrated into all stages of wind tower design, construction, and maintenance.

What types of fasteners are used on the inside of the nacelle in a wind turbine application?

Inside the nacelle of a wind turbine, various types of fasteners are used to assemble, secure, and maintain the components and systems that make up the turbine's operational and control systems. The nacelle houses the generator, gearbox, control electronics, yaw system, and other critical components. Here are some types of fasteners commonly used on the inside of the nacelle in a wind turbine application:

1. **Bolts:** High-strength bolts are commonly used to assemble and secure heavy components like the gearbox, generator, and other structural elements within the nacelle.
2. **Nuts:** Nuts are paired with bolts to secure them in place, providing a reliable connection between components.
3. **Washers:** Washers are used with bolts and nuts to distribute the load evenly over surfaces and prevent damage to the connected materials.
4. **Screws:** Various types of screws are used for securing smaller components, panels, covers, and electronics within the nacelle.
5. **Threaded Rods:** Threaded rods can be used to create secure connections between components or to support systems like cable trays and conduits.
6. **Captive Fasteners:** Captive fasteners, such as captive screws, are designed to remain attached to a component even when loosened, preventing loss during maintenance or service.
7. **Clips and Retainers:** Clips and retainers are used to hold cables, wires, and hoses in place, helping to organize and secure the electrical and fluid systems within the nacelle.

8. **Adhesive Fasteners:** Adhesive fasteners or tapes may be used in certain applications to provide additional bonding or attachment of components that can't be easily accessed with traditional mechanical fasteners.
9. **Mounting Hardware:** Various mounting hardware, such as brackets and hangers, may be used to secure components or systems in specific positions within the nacelle.
10. **Locking Mechanisms:** Lock washers, self-locking nuts, or thread-locking compounds can be used to prevent fastener loosening due to vibrations or dynamic loads.
11. **Electrical Connectors:** Fasteners like terminal screws are used to secure electrical connections and wiring within the nacelle's control systems.
12. **Cable Ties:** Cable ties are used to bundle and secure cables and wiring, keeping them organized and preventing them from interfering with other components.
13. **Grommets and Bushings:** These fasteners are used to protect cables and wires from sharp edges and provide strain relief, extending their lifespan.
14. **Heat Dissipation Hardware:** In certain applications, fasteners like thermal interface materials, screws, and clips may be used to ensure proper heat dissipation from electronics.
15. **Panel Fasteners:** Quick-release panel fasteners or quarter-turn fasteners may be used to secure access panels and covers for easy maintenance and service.

The specific types of fasteners used within a wind turbine nacelle can vary depending on the turbine model, manufacturer, and the components housed within the nacelle. The choice of fasteners aims to ensure the safe and reliable operation of the wind turbine while facilitating access for maintenance and service activities.

What are the different applications inside the nacelle that require fasteners?

Inside the nacelle of a wind turbine, numerous applications require the use of fasteners to assemble, secure, and maintain various components and systems. The nacelle houses critical components responsible for power generation, control, and operation of the wind turbine. Here are some of the different applications inside the nacelle that require fasteners:

1. **Generator:** Fasteners are used to secure the generator components and its housing, as well as to attach cables and wiring for power transmission.
2. **Gearbox:** Fasteners are used to assemble and secure gearbox components, which are responsible for increasing the rotational speed of the turbine's rotor to generate electricity.
3. **Yaw System:** The yaw system allows the turbine to turn and face the wind. Fasteners are used to secure yaw motors, drives, and sensors.
4. **Control Electronics:** Fasteners are used to secure control cabinets, circuit boards, sensors, and wiring related to the turbine's control and monitoring systems.
5. **Pitch System:** The pitch system adjusts the angle of the turbine blades to optimize power generation. Fasteners are used to secure pitch motors, actuators, and sensors.
6. **Hydraulic Systems:** Fasteners are used to assemble and secure hydraulic components for pitch control, braking, and other hydraulic systems within the nacelle.
7. **Cooling Systems:** Fasteners may be used to secure cooling fans, radiators, and heat exchangers that help regulate the temperature of critical components.
8. **Vibration Dampening:** Fasteners can be used to attach vibration dampeners or isolators to reduce vibrations and their impact on sensitive components.

9. **Electrical Systems:** Fasteners secure electrical connections, terminals, relays, and other components related to power distribution, monitoring, and control.
10. **Sensors and Instrumentation:** Fasteners are used to secure various sensors and instrumentation devices that monitor conditions such as wind speed, temperature, and performance.
11. **Access Panels and Covers:** Fasteners secure access panels, doors, and covers that provide maintenance personnel with entry points to perform inspections, repairs, and servicing.
12. **Lighting:** Fasteners are used to secure lighting fixtures inside the nacelle, providing adequate visibility for maintenance tasks.
13. **Fire Suppression Systems:** Fasteners can be used to secure fire suppression system components to mitigate fire risks within the nacelle.
14. **Communication Equipment:** Fasteners secure communication devices and equipment used for remote monitoring and data transmission.
15. **Hub Components:** Inside the hub of the turbine, fasteners secure the individual blades to the hub assembly.
16. **Blade Pitch Actuators:** Fasteners are used to secure blade pitch actuators, which control the angle of the turbine blades.
17. **Transformer and Power Conversion:** Fasteners may be used to secure power conversion equipment and transformers for converting generated power to the grid's voltage level.
18. **Data Collection Devices:** Fasteners secure devices used to collect operational and performance data, contributing to predictive maintenance and optimization.

These are just a few examples of the various applications within the nacelle that require fasteners. Wind turbine manufacturers design and engineer their nacelles with careful consideration of fastener selection to ensure the safe, reliable, and efficient operation of the turbine throughout its operational life.

USING THREAD LUBRICANTS WHEN SECURING FASTENERS & WHAT IS YIELD STRENGTH

Using thread lubricants when securing fasteners serves several important purposes in various applications:

1. **Reduced Friction:** Thread lubricants, also known as thread or bolt lubricants, reduce friction between the threads of fasteners and the surfaces they contact. This is crucial during the tightening process, as friction can make it difficult to apply the desired torque accurately. By reducing friction, lubricants help ensure that the applied torque is distributed more evenly and accurately, leading to consistent and reliable fastener installation.
2. **Improved Torque-Tension Relationship:** The torque applied to a fastener doesn't directly correlate with the tension (preload) in the fastener. Factors like friction, surface condition, and material properties can influence this relationship. Lubricants minimize the variability introduced by friction, allowing for a more predictable and repeatable relationship between applied torque and the resulting tension in the fastener. This is essential for maintaining consistent clamp loads and preventing fastener failures due to inadequate tension or overtightening.
3. **Prevention of Galling:** Galling, also known as cold welding or seizing, occurs when two metal surfaces in contact experience excessive friction and pressure, causing them to stick together and deform. This can result in damaged threads, increased tightening torque, and even the need to cut off or replace the fastener. Lubricants create a barrier between metal surfaces, reducing the likelihood of galling and extending the lifespan of the fastener and mating parts.

4. **Corrosion Protection:** Thread lubricants often include corrosion inhibitors that protect fasteners from rust and other forms of corrosion. Corrosion can weaken the fastener and compromise its integrity over time. By using lubricants with anti-corrosion properties, you help extend the life of the fasteners, particularly in outdoor or harsh environments.
5. **Easier Assembly and Disassembly:** Lubricated threads are easier to assemble and disassemble. When it's time to remove the fastener, the reduced friction minimizes the risk of threads getting damaged or jammed, making maintenance and repairs more efficient.
6. **Consistency and Reliability:** By using thread lubricants consistently, you establish a controlled and repeatable process for fastener installation. This leads to higher reliability and quality in the final product, which is especially important in industries where safety and precision are paramount.
7. **Cost Savings:** While it might seem like an additional step, using thread lubricants can lead to cost savings over time. Properly lubricated fasteners are less likely to fail prematurely, reducing the need for frequent replacements, maintenance, and associated downtime.

It's important to note that the choice of lubricant should be appropriate for the specific application and materials involved. Different lubricants are designed for various conditions, such as high-temperature environments, extreme pressures, or specific types of metals. When selecting a lubricant, consider factors like compatibility with materials, operating conditions, and the manufacturer's recommendations for the fasteners being used.

There are several types of thread lubricants available, each designed to address specific needs and conditions. The choice of lubricant depends on factors such as the application environment, the type of fasteners, the materials being joined, and the required performance characteristics. Here are some common types of thread lubricants, along with their differences and benefits:

1. **Anti-Seize Compounds:**

Composition: Anti-seize compounds are usually made from a mixture of lubricating solids (such as graphite, molybdenum disulfide) suspended in a grease or carrier fluid.

Benefits: Anti-seize compounds are primarily used to prevent galling, seizing, and fretting corrosion in metal-to-metal threaded connections. They create a protective barrier that prevents direct metal-to-metal contact, reducing friction and preventing thread damage during assembly and disassembly. They're often used in high-temperature and high-pressure environments.

2. **Thread Sealants:**

Composition: Thread sealants are formulated with sealant materials suspended in a liquid or paste carrier, which hardens or cures to form a seal.

Benefits: Thread sealants are designed to create a leak-proof seal on threaded connections. They are commonly used on pipe fittings and connections that handle liquids or gases under pressure. They prevent leakage by filling microscopic imperfections in the threads and creating a barrier against fluids. They also offer some degree of lubrication during assembly.

3. **Thread Cutting Fluids:**

Composition: Thread cutting fluids are liquids designed to aid in the machining or cutting of threads.

Benefits: These fluids provide lubrication and cooling during the thread cutting process, reducing friction and heat buildup. They help extend the life of cutting tools and improve the quality of the finished threads by reducing the risk of tool wear and workpiece damage.

4. **Assembly Pastes:**

Composition: Assembly pastes are semi-solid lubricants that contain lubricating solids suspended in a grease or carrier fluid.

Benefits: Assembly pastes are used to improve the torque-tension relationship during fastener installation. They reduce friction and allow for more accurate torque application, resulting in consistent and predictable preload. These pastes are often used in applications where accurate tension control is crucial.

5. **High-Temperature Lubricants:**

Composition: High-temperature lubricants are formulated to withstand extreme heat without breaking down or evaporating.

Benefits: These lubricants are used in environments where temperatures are high, such as in engines, exhaust systems, and industrial equipment. They provide consistent lubrication and protection under extreme conditions, preventing fastener failures due to heat-induced wear or friction.

6. **Synthetic Lubricants:**

Composition: Synthetic lubricants are engineered lubricants with specific performance properties and characteristics.

Benefits: Synthetic lubricants can offer a range of benefits, including improved lubrication, higher temperature resistance, enhanced corrosion protection, and reduced friction. They are often chosen for applications that demand specialized performance beyond what traditional lubricants can provide.

When selecting a thread lubricant, it's important to consider the specific requirements of your application, such as temperature, pressure, materials, and environmental factors. Always follow manufacturer recommendations and guidelines for proper lubricant application to ensure optimal performance and reliability of the threaded connections.

What part does coefficient of friction play in securing fasteners?

The coefficient of friction plays a critical role in securing fasteners due to its direct impact on the amount of torque required to achieve a specific level of clamping force or preload. The coefficient of friction is a dimensionless value that represents the ratio of the force of friction between two surfaces to the normal force pressing them together. In the context of securing fasteners, the coefficient of friction between the threaded surfaces of the fastener and the mating parts affects how much resistance or friction is encountered as the fastener is tightened.

Here's how the coefficient of friction influences fastener securing:

1. **Torque-Clamp Relationship:** When you apply a torque (twisting force) to tighten a fastener, a significant portion of that torque is used to overcome the friction between the threads of the fastener and the mating surfaces. The higher the coefficient of friction, the more torque is needed to achieve the same clamping force (preload) on the fastener. Conversely, a lower coefficient of friction requires less torque for the same preload.
2. **Consistency in Preload:** Achieving consistent and accurate preload across multiple fasteners is essential for uniform and reliable joint performance. If the coefficient of friction varies between fasteners due to factors like surface finish or lubrication, it can result in inconsistent preloads even when the same torque is applied. This variability can lead to joint failures, leaks, or reduced structural integrity.
3. **Overcoming Scatter in Coefficient Values:** Different materials, surface finishes, and lubrication levels can lead to variations in the coefficient of friction. Engineers often rely on tightening torque guidelines based on empirical or theoretical data. The chosen torque

values are intended to achieve a target preload, accounting for the expected coefficient of friction in a given application.

4. **Tightening Process Control:** Accurate torque application is crucial for preventing overtightening (which can damage threads or lead to fastener failure) and under tightening (which might result in insufficient clamping force). By understanding and accounting for the coefficient of friction, the torque settings can be adjusted to ensure the desired preload is consistently achieved.

Selection of Lubricants: Choosing the appropriate lubricant can have a significant impact on the coefficient of friction. Lubricants reduce friction and can help achieve more consistent and predictable results during the tightening process. The right lubricant can minimize friction variations caused by factors like surface roughness, corrosion, or temperature.

In summary, the coefficient of friction directly influences the relationship between the applied torque and the resulting preload on a fastener. Engineers and technicians need to consider the coefficient of friction when designing, installing, and maintaining threaded connections to ensure uniform and reliable joint performance. This consideration is essential for preventing joint failures, optimizing torque control, and achieving consistent results across various applications.

When referring to securing a fastener, what is yield?

When referring to securing a fastener, "yield" typically refers to the concept of "yielding" or "yield strength." Yield strength is a mechanical property of a material, and it plays a crucial role in the design and analysis of fastened joints.

Yield strength is the point at which a material begins to undergo permanent deformation, also known as plastic deformation, under an applied load. In the context of securing a fastener, yield strength is important because it helps determine the maximum load or force a fastened joint can sustain before the fastener or the connected parts experience permanent deformation.

Here's how yield strength relates to securing fasteners:

1. **Design Considerations:** Engineers need to ensure that the yield strength of the fastener and the materials being fastened is appropriately matched to the expected loads. The yield strength of the fastener and the materials it joins should be higher than the maximum loads the joint will experience. This ensures that the joint remains within the elastic region of the material's stress-strain curve, where deformations are fully recoverable upon release of the load.
2. **Preload and Joint Integrity:** When a fastener is tightened, it induces a clamping force or preload on the joint. This preload should be within the elastic limit of the materials involved, meaning that the materials don't experience permanent deformation. Exceeding the yield strength during tightening could lead to permanent plastic deformation, which can compromise joint integrity and lead to reduced clamping force or even joint failure.
3. **Elastic Deformation:** In an ideal situation, the fastener would provide enough preload to maintain the clamping force without exceeding the yield strength of the materials. This way, the joint experiences only elastic deformation, where the materials return to their original shape after the load is removed. Elastic deformation ensures that the joint remains secure and capable of accommodating external loads without permanent changes.
4. **Stress Distribution:** Understanding yield strength is essential for distributing stress effectively across the joint components. Properly designed joints distribute the load across multiple fasteners or points of contact, preventing localized stress concentrations that could lead to material failure.

In summary, "yield" when referring to securing a fastener pertains to the yield strength of the materials involved in the joint. Engineers must carefully consider the yield strength of the fastener and the materials being fastened to ensure that the joint remains within the elastic range and can withstand the anticipated loads without undergoing permanent deformation. This attention to yield strength is essential for maintaining joint integrity and ensuring the reliability and longevity of the fastened connection.

What is the known coefficient of friction for the above lubricants?

The coefficient of friction for different lubricants can vary depending on factors such as the specific formulation of the lubricant, the materials being used, the application conditions, and the testing method employed. Therefore, providing an exact or universal coefficient of friction for each type of lubricant is challenging. However, I can offer some general ranges and trends based on common lubricants:

1. **Anti-Seize Compounds:** The coefficient of friction for anti-seize compounds can vary depending on the specific formulation. Generally, anti-seize compounds are designed to reduce friction significantly and are often in the range of 0.1 to 0.2.
2. **Thread Sealants:** Thread sealants are not primarily intended for reducing friction but for sealing threaded connections. Therefore, their coefficient of friction may vary, but it is generally higher than that of dedicated lubricants, often falling in the range of 0.2 to 0.4.
3. **Thread Cutting Fluids:** Thread cutting fluids are used during the machining process and typically have a lower coefficient of friction to aid in cutting. The coefficient of friction for thread cutting fluids can vary but is generally lower, possibly around 0.1 to 0.2.

4. **Assembly Pastes:** Assembly pastes are formulated to reduce friction during the tightening process, so their coefficient of friction is usually on the lower end. Coefficients of around 0.1 to 0.2 are not uncommon for assembly pastes.
5. **High-Temperature Lubricants:** High-temperature lubricants are formulated to withstand extreme conditions, and their coefficients of friction can vary based on the application. However, they are often designed to maintain low friction, potentially falling in the range of 0.1 to 0.2.
6. **Synthetic Lubricants:** Synthetic lubricants can vary widely in their coefficients of friction depending on the formulation. They are often designed to provide low friction and high performance, and their coefficients can be in the range of 0.05 to 0.2 or lower.

Keep in mind that these coefficients of friction are approximate and can be affected by factors such as surface roughness, temperature, pressure, and the specific materials involved. Additionally, real-world coefficients of friction can differ from laboratory measurements due to these variables**. If you need precise values for your application, it's recommended to consult with the lubricant manufacturer or conduct tests under conditions similar to your intended use.**

FASTENER TENSIONING TOOLS

Tensioning fasteners, such as bolts and nuts, is an important aspect of many mechanical and construction applications to ensure proper joint integrity. There are several types of tools available for tensioning fasteners, each designed for specific purposes and varying levels of precision. Some of the common types of tensioning tools include:

Torque Wrenches: Torque wrenches are widely used tools that apply a specific amount of torque to a fastener. They come in various types, including click-type, beam-type, and electronic torque wrenches. These tools are easy to use and provide a reliable way to apply a predetermined level of tension to a fastener.

Hydraulic Tensioning Tools: Hydraulic tensioners use hydraulic pressure to apply a specific tension to a fastener. They are commonly used in heavy industrial applications and are capable of providing accurate and uniform tension across multiple fasteners.

Pneumatic Tensioning Tools: Similar to hydraulic tensioners, pneumatic tensioners use compressed air to generate tension. They are suitable for applications where hydraulic systems might not be feasible.

Nut Runners: Nut runners are high-torque tools designed to quickly and precisely tighten nuts. They are commonly used in industrial settings where large bolts and nuts need to be tightened efficiently.

Bolt Tensioners: Bolt tensioners are specialized tools used to stretch a bolt before tightening the nut. This method helps achieve more accurate and consistent tension in critical applications.

Ultrasonic Tensioning Tools: Ultrasonic tensioning tools use ultrasonic waves to measure the elongation of a fastener and provide feedback on the achieved tension. They offer high accuracy and are often used in applications where precise tension control is essential.

Electronic Tensioning Tools: These tools incorporate sensors and electronic displays to provide real-time feedback on the applied tension. They can be used in conjunction with torque and angle measurements for enhanced accuracy.

Manual Tensioning Tools: These include simple hand tools like spanners, wrenches, and sockets that are used to manually tighten fasteners. While they might lack the precision of more advanced tools, they are still widely used in various applications.

Stud Tensioners: Stud tensioners are designed specifically for threaded studs. They help achieve accurate tensioning by stretching the stud before securing the nut.

Tensioning Calibrators: These tools are used to calibrate and verify the accuracy of other tensioning tools, ensuring that they provide the intended level of tension.

When selecting a tensioning tool, it's important to consider factors such as the application, required level of accuracy, available space, budget, and the specific type of fastener being used. Proper training and understanding of the chosen tool are crucial to ensure safe and effective fastener tensioning.

What are the advantages and disadvantages of each of the above tensioning tools?

Here's a breakdown of the advantages and disadvantages of each of the tensioning tools mentioned earlier:

1. **Torque Wrenches**:

Advantages:

Widely available and easy to use.

Relatively inexpensive.

Suitable for a wide range of applications.

Disadvantages:

Accuracy can be affected by factors like lubrication, surface condition, and operator technique.

Limited accuracy for highly critical applications.

2. **Hydraulic Tensioning Tools**:

Advantages:

Provide accurate and uniform tension across multiple fasteners.

Suitable for high-load applications.

Can be used in tight spaces.

Disadvantages:

Initial cost and setup can be higher.

Requires hydraulic systems, which may require maintenance.

Operator training is important.

3. **Pneumatic Tensioning Tools**:

Advantages:

Similar advantages to hydraulic tensioning tools but use compressed air instead.

Easier setup compared to hydraulic tools.

Disadvantages:

Accuracy might be affected by air pressure fluctuations.

Requires a source of compressed air.

4. **Nut Runners**:

Advantages:

High torque output for quick tightening.

Suitable for heavy industrial applications.

Can be used in confined spaces.

Disadvantages:

Limited precision compared to torque or tension control tools.

Can potentially overtighten fasteners.

5. **Bolt Tensioners**:

Advantages:

Accurate and consistent tension across fasteners.

Suitable for critical applications.

Can compensate for elastic elongation of fasteners.

Disadvantages:

More complex setup compared to basic torque tools.

Require accurate measurements of elongation.

6. **Ultrasonic Tensioning Tools**:

Advantages:

High accuracy and repeatability.

Non-contact measurement method.

Suitable for critical applications.

Disadvantages:

Higher cost compared to some other tools.

Requires training for proper usage.

7. **Electronic Tensioning Tools**:

Advantages:

Real-time feedback on applied tension.

Can combine torque and angle measurements for accuracy.

Disadvantages:

Costlier than basic torque tools.

May require batteries or power sources.

Operator training is important.

8. **Manual Tensioning Tools**:

Advantages:

Simple and widely available.

Inexpensive.

Suitable for non-critical applications.

Disadvantages:

Limited accuracy and repeatability.

Operator skill plays a significant role.

Not suitable for precision applications.

9. **Stud Tensioners**:

Advantages:

Designed for threaded studs, ensuring proper tension.

Accurate and reliable.

Disadvantages:

Application limited to threaded studs.

10. **Tensioning Calibrators**:

Advantages:

Ensures accurate calibration of other tools.

Enhances tool reliability.

Disadvantages:

Usually not used directly for tensioning.

When selecting a tensioning tool, consider the specific needs of your application, the required level of accuracy, the type of fastener, and the available budget. Additionally, proper training and understanding of the chosen tool are crucial to achieving accurate and reliable tensioning results.

HOT BOLTING TOOLS

Hot bolting, also known as "hot torquing," is a maintenance process used to tighten or loosen fasteners (such as nuts and bolts) in high-temperature environments, typically found in industries like petrochemical, power generation, and refining. The goal of hot bolting is to maintain the integrity of bolted connections that may have loosened due to thermal expansion and contraction.

When performing hot bolting, it's crucial to use the right tools and equipment to ensure safety, accuracy, and efficiency. The best type of tool to use for hot bolting depends on the specific circumstances and requirements of the task. Here are a few common types of tools used for hot bolting:

When performing hot bolting, it's crucial to use the right tools and equipment to ensure safety, accuracy, and efficiency. The best type of tool to use for hot bolting depends on the specific circumstances and requirements of the task. Here are a few common types of tools used for hot bolting:

1. **Hydraulic Torque Wrenches:** Hydraulic torque wrenches are widely used in hot bolting applications because they offer precise torque application in high-temperature environments. These tools use hydraulic pressure to apply controlled torque to fasteners, making them suitable for accurately tightening or loosening bolts in challenging conditions.
2. **Induction Heaters:** Induction heaters are used to heat up nuts and bolts before torquing. They work by using electromagnetic induction to heat the fasteners quickly and uniformly. Induction heaters are effective for loosening stubborn, seized, or corroded fasteners, allowing for easier removal or tightening.
3. **Temperature-Resistant Materials:** In some cases, specially designed fasteners made from high-temperature-resistant materials, such as nickel alloys or superalloys, may be used to withstand the extreme conditions of hot bolting. These materials can maintain their mechanical properties at elevated temperatures.

4. **Torque Multipliers:** Torque multipliers are mechanical devices that help generate higher torque levels with less physical effort. They can be useful for applying high torque to large or stubborn fasteners in high-temperature environments.
5. **Safety Equipment:** Safety is paramount in hot bolting. Personal protective equipment (PPE), such as heat-resistant gloves, goggles, and flame-resistant clothing, should be worn by personnel performing hot bolting tasks.
6. **Calibration and Measurement Tools:** Accurate torque measurement is essential in hot bolting to ensure proper fastener tension. Torque wrenches and other torque measurement tools should be calibrated regularly to maintain accuracy.

When selecting tools for hot bolting, consider factors such as the temperature of the environment, the size and type of fasteners, the desired torque levels, and the condition of the fasteners. It's also crucial to follow proper procedures and guidelines for hot bolting to ensure the safety of personnel and the integrity of the equipment being worked on. Always consult with industry experts and adhere to relevant safety standards when performing hot bolting operations.

What procedures should be used when hot bolting with hydraulic torque wrenches?

Hot bolting with hydraulic torque wrenches requires careful planning, preparation, and execution to ensure the safety of personnel and the integrity of the equipment. Here's a general overview of the procedures that should be followed when performing hot bolting with hydraulic torque wrenches:

1. **Risk Assessment and Safety Precautions:**

Conduct a thorough risk assessment of the work area and identify potential hazards associated with the high-temperature environment.

Ensure that all personnel involved are equipped with appropriate personal protective equipment (PPE) such as heat-resistant gloves, goggles, and flame-resistant clothing.

Establish proper communication procedures and emergency protocols.

2. **Selection of Tools and Equipment:**

Choose the appropriate hydraulic torque wrenches based on the size, type, and torque requirements of the fasteners.

Ensure that the hydraulic torque wrenches are properly calibrated and in good working condition.

3. **Preparation of Work Area:**

Clean the area around the fasteners to be worked on to prevent debris or contaminants from interfering with the bolting process.

Make sure there is adequate space for personnel to work safely.

4. **Heating (If Required):**

If the fasteners are corroded or stuck, consider using an induction heater to heat them up and aid in their removal.

Follow manufacturer guidelines for the safe and effective use of the induction heater.

5. **Torque Application:**

Position the hydraulic torque wrench properly on the fastener, ensuring that it is aligned correctly and securely.

Set the hydraulic torque wrench to the desired torque level, considering the temperature-related changes in material properties.

Gradually apply torque using the hydraulic torque wrench, monitoring the tension on the fastener carefully.

6. **Monitoring and Verification:**

Use calibrated torque measurement equipment to ensure that the correct torque is being applied to the fastener.

Monitor the fastener to verify that it is moving or tightening as expected.

Avoid over-tightening, as this can lead to damage or failure of the fastener.

7. **Cooling (If Required):**

If the fasteners need to be loosened, allow them to cool down gradually before attempting removal to avoid damaging the threads.

8. **Post-Bolting Checks:**

Inspect the fasteners and connections after the bolting process to ensure that they are properly tightened and secured.

Address any issues or anomalies that may have arisen during the bolting process.

9. **Documentation:**

Keep thorough records of the bolting process, including torque values, dates, personnel involved, and any observations.

10. **Personnel Training:**

Ensure that personnel involved in hot bolting are adequately trained in the proper use of hydraulic torque wrenches and the associated safety procedures.

It's important to note that specific procedures may vary depending on the equipment, industry standards, and the specific requirements of the bolting task. Always refer to manufacturer guidelines, industry best practices, and relevant safety regulations when performing hot bolting operations. If in doubt, consult with experienced professionals in the field of hot bolting.

What issues should be avoided when hot bolting fasteners with hydraulic torque wrenches?

When hot bolting fasteners with hydraulic torque wrenches, there are several potential issues that should be avoided to ensure the safety of personnel, the integrity of equipment, and the successful completion of the bolting process. Here are some key issues to be aware of and avoid:

1. **Insufficient Safety Precautions:**

Failure to use appropriate personal protective equipment (PPE) can lead to burns, injuries, or exposure to hazardous substances. Always ensure that personnel are properly equipped with heat-resistant gloves, goggles, and flame-resistant clothing.

2. **Lack of Proper Planning:**

Failing to conduct a thorough risk assessment and plan the bolting process can lead to accidents, unexpected challenges, and delays. Proper planning ensures that potential hazards are identified and mitigated.

3. **Inaccurate Torque Application:**

Applying incorrect torque levels can result in inadequate or excessive tightening of fasteners, leading to leakages, equipment failure, or unsafe conditions. Always use calibrated torque measurement equipment and follow manufacturer guidelines.

4. **Over-Tightening:**

Over-tightening fasteners can cause material deformation, galling, or even breakage. This can compromise the structural integrity of the equipment and make future maintenance difficult. Follow recommended torque values and procedures to prevent over-tightening.

5. **Under-Tightening:**

Under-tightening can lead to leakages, vibrations, and equipment instability. Insufficiently tightened fasteners might not provide the necessary sealing or structural support. Ensure that fasteners are tightened to the appropriate torque specifications.

6. **Improper Tool Usage:**

Incorrect use of hydraulic torque wrenches can result in damaged equipment, stripped threads, or operator injuries. Adequate training is crucial to ensure that personnel know how to properly handle and operate these tools.

7. **Ignoring Material Properties:**

Failure to account for material properties at high temperatures can lead to inaccurate torque values. Different materials behave differently under thermal stress, affecting their elasticity and elongation. Adjust torque values accordingly.

8. **Skipping Heating or Cooling Steps:**

If fasteners are corroded or stuck, skipping the heating or cooling steps can lead to excessive force being applied, which can damage the fasteners, threads, or surrounding equipment.

9. **Inadequate Documentation:**

Failing to document the bolting process, including torque values, dates, and personnel involved, can lead to confusion, miscommunication, and difficulty in tracing maintenance activities.

10. **Ignoring Manufacturer Guidelines:**

Hydraulic torque wrenches and other equipment have specific guidelines provided by manufacturers. Ignoring these guidelines or using tools outside their specified capabilities can lead to improper results and safety hazards.

11. **Rushing the Process:**

Rushing through the bolting process can lead to mistakes, inaccuracies, and unsafe conditions. Take the necessary time to follow proper procedures and ensure accurate torque application.

12. **Inadequate Training:**

Inadequately trained personnel might make mistakes or overlook important steps in the bolting process. Proper training ensures that operators are knowledgeable about the tools and procedures involved.

To avoid these issues, it's essential to follow industry best practices, manufacturer guidelines, and relevant safety standards when performing hot bolting with hydraulic torque wrenches. If you're unsure about any aspect of the process, consult with experienced professionals or seek guidance from your organization's maintenance experts.

What are the advantages of hot bolting fasteners with hydraulic torque wrenches over other methods of tightening fasteners?

Hot bolting fasteners with hydraulic torque wrenches offers several advantages over other methods of tightening fasteners, especially in high-temperature environments. Here are some of the key advantages:

1. **Precision and Accuracy:** Hydraulic torque wrenches provide precise and accurate torque application, ensuring that fasteners are tightened to the desired specifications. This accuracy is crucial for maintaining proper sealing, preventing leaks, and ensuring the structural integrity of equipment.
2. **Consistency:** Hydraulic torque wrenches allow for consistent torque application across multiple fasteners. This helps to achieve uniform and reliable bolted connections throughout the equipment.
3. **Reduced Risk of Galling:** Galling is a common issue when fasteners are tightened under high pressure. Hydraulic torque wrenches apply torque smoothly and evenly, reducing the risk of galling, which can damage the threads and compromise the integrity of the fastener.
4. **Time Efficiency:** Hydraulic torque wrenches can speed up the bolting process compared to manual methods. They provide rapid torque application and reduce the time required for tightening or loosening fasteners, leading to increased operational efficiency.
5. **Operator Safety:** Hydraulic torque wrenches reduce the physical effort required by operators, minimizing the risk of fatigue, strain, and injuries.

This is especially important in high-temperature environments where manual labor can be physically demanding.

6. **Adaptability to High Temperatures:** Hydraulic torque wrenches are designed to function in high-temperature environments. They can withstand the heat without compromising their performance, making them suitable for bolting tasks in industries like petrochemical, power generation, and refining.
7. **Reduced Heat-Related Expansion Issues:** In high-temperature environments, materials can expand and contract, potentially loosening fasteners. Hot bolting with hydraulic torque wrenches helps to address this issue by providing controlled tightening after thermal cycling.
8. **Ease of Use:** Hydraulic torque wrenches are relatively easy to use and require minimal training for operators. Their design allows for straightforward setup and operation, reducing the likelihood of errors.
9. **Remote Operation:** Some hydraulic torque wrenches can be operated remotely, allowing personnel to maintain a safe distance from the high-temperature environment during the bolting process. This enhances operator safety and reduces exposure to heat.
10. **Conservation of Energy:** Hydraulic torque wrenches use hydraulic pressure to generate torque, conserving the energy of the operator and reducing the physical demands of the bolting process.
11. **Reduced Downtime:** Rapid and accurate torque application with hydraulic torque wrenches can lead to reduced equipment downtime during maintenance or repair activities.
12. **Traceability and Documentation:** Many hydraulic torque wrenches can record torque values and other relevant data, providing traceability and documentation for maintenance and quality control purposes.

While hydraulic torque wrenches offer numerous advantages for hot bolting fasteners, it's important to choose the appropriate tool and follow proper procedures to ensure their effective use. Always consider the specific requirements of the task, the environment, and the equipment being worked on when selecting the bolting method and tools.

Hot bolting refers to the process of replacing or tightening bolts on equipment, machinery, or piping systems while they are still in operation and at high temperatures. This technique is often used in industries such as petrochemical, power generation, and manufacturing, where shutting down the system for maintenance is not feasible due to production requirements. Hot bolting requires specialized tools and techniques to ensure safety and effectiveness in these challenging conditions.

What is the best procedure for hot bolting?

The procedure for hot bolting should prioritize safety and effectiveness. Here's a general outline of the steps involved:

1. **Safety Precautions**: Ensure proper training and protective gear for the personnel involved. Understand the risks associated with high temperatures, pressure, and confined spaces.
2. **Assessment**: Evaluate the need for hot bolting, considering factors like leakages, corrosion, or loss of integrity. Plan the scope of work and identify which bolts need replacement or tightening.
3. **Equipment Preparation**: Gather the necessary tools, including specialized high-temperature wrenches, extension bars, lubricants, and insulation materials. Ensure that all equipment is properly calibrated and in good working condition.
4. **Isolation and Depressurization**: If possible, isolate the section of the system being worked on to minimize exposure to high temperatures and pressure. Depressurize the system safely following proper procedures.
5. **Heat Shielding**: Install heat-resistant shields or blankets around the work area to protect personnel from the high temperatures.
6. **Cooling Period**: Allow the equipment to cool down slightly before starting the hot bolting process. This reduces the risk of burns and improves the accuracy of torque values.
7. **Bolt Removal/Replacement**: Carefully remove the old bolts using the appropriate tools. Replace them with new bolts as needed. Apply

lubricants or anti-seize compounds to prevent corrosion and make future maintenance easier.

8. **Torque Application**: Use torque wrenches designed for high-temperature environments to tighten the bolts according to manufacturer specifications. Ensure uniform torque application to avoid stress concentration.
9. **Quality Checks**: Verify the proper torque values and alignment of the bolted connections. Inspect for any signs of leakage or misalignment.
10. **Insulation and Re-pressurization**: If applicable, reapply insulation materials to maintain temperature stability. Gradually re-pressurize the system while monitoring for leaks.
11. **Documentation**: Keep detailed records of the hot bolting procedure, including torque values, bolt replacements, and any anomalies encountered. This information is crucial for future maintenance and integrity assessments.
12. **Post-Procedure Evaluation**: After completing the hot bolting, monitor the system for a period to ensure that the newly bolted connections are functioning as intended and that there are no leaks or issues.

Remember that the specifics of the procedure may vary depending on the equipment, industry, and regulations in place. Always consult with experts who have experience in hot bolting for your particular application.

What errors should be avoided when hot bolting?

When performing hot bolting, several errors should be avoided to ensure the safety of personnel, the integrity of the equipment, and the effectiveness of the maintenance process. Here are some key errors to watch out for:

1. **Insufficient Safety Precautions**: Neglecting proper safety gear, training, and precautions can lead to serious injuries due to the high temperatures, pressure, and potential hazards involved.

2. **Inadequate Planning**: Failing to assess the scope of work, determine which bolts need attention, or adequately prepare for the procedure can result in inefficiencies and safety risks.
3. **Incorrect Torque Application**: Applying incorrect torque values or using improper torque wrenches can lead to uneven or inadequate bolt tightening, which can result in leaks, bolt failures, or compromised equipment integrity.
4. **Over-Torquing or Under-Torquing**: Applying too much or too little torque can both be problematic. Over-tightening can damage bolts or equipment, while under-tightening can lead to leaks and poor connections.
5. **Lack of Proper Tools and Equipment**: Using incorrect or substandard tools for hot bolting can lead to inaccurate torque application, delays in the procedure, or unsafe conditions.
6. **Inadequate Cooling Time**: Starting the bolting process too soon after equipment shutdown can result in burns, as the equipment may still be dangerously hot.
7. **Neglecting Thermal Expansion**: Not accounting for the thermal expansion of the equipment during hot bolting can result in improper alignment of bolted connections, leading to leaks or stress concentration.
8. **Improper Bolt Replacement**: Using incorrect or incompatible bolts during replacement can compromise the structural integrity of the system and lead to failures.
9. **Inaccurate Documentation**: Failing to document torque values, bolt replacements, and other relevant information can make it difficult to track maintenance history and assess the integrity of the system in the future.
10. **Ignoring Manufacturer Guidelines**: Neglecting manufacturer recommendations, guidelines, and specifications for hot bolting procedures can result in suboptimal maintenance outcomes and potential safety risks.
11. **Rushing the Process**: Hurrying through the hot bolting process without proper attention to detail can lead to mistakes, compromised connections, and safety hazards.
12. **Lack of Quality Control**: Not conducting thorough quality checks and inspections after hot bolting can lead to undetected issues that may become critical over time.

To avoid these errors, it's crucial to have experienced personnel who are knowledgeable about hot bolting techniques and to adhere to industry best practices and guidelines. When in doubt, consulting with experts in the field can help ensure a successful and safe hot bolting procedure.

NUTS AND BOLTS AND STUDS

What is a fasteners yield strength, and how important is it?

A fastener's yield strength is the maximum amount of stress or load that a fastener, such as a bolt or screw, can withstand before it undergoes permanent deformation or "yielding." In other words, it's the point at which the fastener starts to stretch or deform permanently under the applied load. Yield strength is typically measured in units of force per unit area, such as pounds per square inch (psi) or megapascals (MPa).

The yield strength is a crucial mechanical property to consider when selecting fasteners for a particular application. Here's why it's important:

1. **Structural Integrity:** Choosing a fastener with an appropriate yield strength ensures that the fastener can bear the intended load without breaking or undergoing excessive deformation. This is particularly crucial in applications where the fasteners are used to hold together critical structures, as failure could lead to catastrophic consequences.
2. **Safety:** Using fasteners with a lower yield strength than required could lead to unexpected failures, posing safety risks to both people and property. Overloading a fastener beyond its yield strength can result in structural collapse or component malfunction.
3. **Design and Reliability:** Engineers and designers need to consider the yield strength of fasteners when designing systems and structures. The yield strength helps them determine the appropriate size and material of fasteners to ensure that the components can withstand the expected loads and forces over time.
4. **Fatigue Resistance:** Fasteners can experience cyclic loading, such as vibrations or thermal expansion/contraction. A higher yield strength

often corresponds to better fatigue resistance, which means the fastener is less likely to fail due to repeated loading and unloading cycles.

5. **Serviceability:** Yield strength can affect the overall performance and longevity of a system. If fasteners yield too easily, they may lose their clamping force, leading to loosening over time and potential functionality issues.
6. **Cost and Efficiency:** Selecting fasteners with an appropriate yield strength helps avoid over-engineering, which can lead to unnecessarily heavy, bulky, or expensive designs. On the other hand, using fasteners with insufficient yield strength might necessitate using more fasteners or larger sizes, increasing material and labor costs.

In summary, understanding and considering the yield strength of fasteners are crucial steps in engineering and design to ensure the safety, reliability, and performance of structures and systems. The appropriate choice of fasteners based on their yield strength helps strike a balance between strength, reliability, and cost-effectiveness.

What is the range of fasteners available based on yield strength?

The range of fasteners available based on yield strength can vary significantly depending on the type of fastener, the material it's made from, and the intended application. Below are some general categories of fasteners based on their yield strength:

1. **Low-Strength Fasteners:**

Yield Strength: Up to around 45,000 psi (310 MPa)

Materials: Mild steel, low-carbon steel, aluminum

Applications: Non-critical applications where strength is not a primary concern, such as light-duty woodworking or temporary assemblies.

2. **Medium-Strength Fasteners:**

Yield Strength: 45,000 psi to 120,000 psi (310 MPa to 830 MPa)

Materials: Medium-carbon steel, alloy steel, some stainless steels

Applications: General-purpose applications in construction, automotive, machinery, and various industrial settings.

3. **High-Strength Fasteners:**

Yield Strength: 120,000 psi to 180,000 psi (830 MPa to 1240 MPa)

Materials: High-strength alloy steel, heat-treated steel, some stainless steels

Applications: Structural applications, heavy machinery, automotive chassis, and components subject to higher loads and stresses.

4. **Ultra-High-Strength Fasteners:**

Yield Strength: Above 180,000 psi (1240 MPa)

Materials: Exotic alloy steels, titanium alloys

Applications: Aerospace, defense, high-performance racing, and specialized applications requiring extreme strength and reliability.

It's important to note that these ranges are approximate and can vary based on specific material grades, manufacturing processes, and industry standards. Additionally, different countries and industries might have their own classifications and standards for fastener strength.

When selecting fasteners, engineers and designers consider factors such as the load-bearing requirements of the application, environmental conditions (corrosion resistance), temperature extremes, and the potential for dynamic loading (vibrations, cyclic loading). Choosing the right fastener with an appropriate yield strength ensures that the fastener can perform reliably and safely within its intended application.

What is the relationship between the stud or bolt and its fastener?

the relationship between a stud, a bolt, and a nut (which is the fastener that secures them together):

Stud: A stud is a type of threaded fastener that has threads on both ends. It's designed to be permanently installed in one component (usually with threads on one end), while the other end remains exposed to accept a nut. Studs are often used to simplify assembly and disassembly processes, especially in situations where it's difficult to access one side of the joint.

Bolt: A bolt is a threaded fastener with a head at one end and threads on the other. It's inserted through holes in two or more components and secured in place using a nut. The head of the bolt provides a bearing surface for tightening, and the threads engage with the nut to create a joint that can be disassembled if needed.

Nut: A nut is a threaded fastener that is used in combination with a bolt or a stud to secure two or more components together. Nuts are threaded internally to match the threads of the bolt or stud. By tightening the nut onto the threads of the bolt or stud, the components are pulled closer together, creating a secure connection.

The relationship between a stud, a bolt, and a nut involves their cooperative use in creating strong and secure connections between components. The bolt or stud provides the clamping force, while the nut locks everything in place. The threads on the bolt, stud, and nut engage with each other, allowing the assembly to be tightened or loosened as needed.

When assembling a joint using a stud, bolt, and nut, the following steps are typically followed:

Insert the stud through a hole in one of the components.

Place the second component over the exposed end of the stud.

Thread the nut onto the exposed end of the stud.

Tighten the nut using a wrench or other suitable tool. As the nut is tightened, it draws the components closer together, creating a secure joint.

The choice of stud, bolt, and nut materials, as well as their sizes, thread types, and torque specifications, are critical considerations in ensuring a strong and reliable connection. Proper assembly techniques and torque values should be followed to achieve the desired clamping force without damaging the components or the fasteners.

What material must the nut be made of, to properly secure the assembly with a stud or bolt?

The material of the nut is an important consideration to ensure proper assembly and secure connections with studs or bolts. The material chosen for the nut should generally have compatible mechanical properties and corrosion resistance with the material of the stud or bolt, as well as the specific requirements of the application. Here are some common materials used for nuts:

1. **Carbon Steel Nuts:** These are commonly used with carbon steel bolts and studs. They are cost-effective and suitable for many general-purpose applications. However, they might not provide the best corrosion resistance in certain environments.
2. **Stainless Steel Nuts:** Stainless steel nuts are corrosion-resistant and can be used with stainless steel bolts or studs. They are suitable for applications where resistance to rust and corrosion is important.

3. **Brass Nuts:** Brass nuts are often used in applications where electrical conductivity is required, or in situations where corrosion resistance is important but stainless steel might not be necessary.
4. **Alloy Steel Nuts:** When using high-strength alloy steel bolts or studs, it's recommended to use nuts made from the same or similar alloy. This helps maintain consistent mechanical properties and ensures compatibility.
5. **Nylon Insert Locknuts:** These are typically made of carbon steel and have a nylon ring inside the threads. They are used to prevent loosening due to vibrations. Nylon insert locknuts are not suitable for high-temperature or high-strength applications.
6. **Aluminum Nuts:** Aluminum nuts are lightweight and corrosion-resistant, making them suitable for certain applications where weight reduction and corrosion resistance are priorities.
7. **Bronze Nuts:** Bronze nuts offer good corrosion resistance and can be used in marine or corrosive environments. They are also used in applications requiring good wear resistance.
8. **Titanium Nuts:** Titanium nuts are lightweight, strong, and corrosion-resistant. They are often used in aerospace and high-performance applications where these properties are crucial.

When selecting a nut material, consider factors such as:

1. **Mechanical Properties:** Ensure that the nut's mechanical properties (such as tensile strength and yield strength) are compatible with the stud or bolt's properties to avoid issues like galling or stripping of threads.
2. **Corrosion Resistance:** Choose a material that is resistant to corrosion in the environment where the assembly will be used.
3. **Temperature Resistance:** Consider the temperature range the assembly will experience. Some materials can withstand higher temperatures without degradation.

4. **Application:** Think about the intended use of the assembly, such as load-bearing requirements, dynamic loads, and other factors that might influence the choice of nut material.
5. **Compatibility:** Ensure that the chosen nut material is compatible with the material of the stud or bolt, as well as any other materials in the assembly. Some materials can react chemically or cause galvanic corrosion when in contact with each other.

Consulting with engineering standards and guidelines specific to your industry can also provide valuable recommendations for selecting the appropriate nut material for your application.

What choices are there for fasteners based on the environment in which they will be used?

The choice of fasteners for specific environments is crucial to ensure their performance, longevity, and resistance to factors like corrosion, temperature extremes, and exposure to chemicals. Here are some considerations and choices for fasteners based on different environmental conditions:

1. **Corrosive Environments (Saltwater, Chemicals):**

Stainless Steel: Stainless steel fasteners (e.g., 304, 316) offer excellent corrosion resistance and are suitable for marine environments and areas with exposure to chemicals.

Alloy Fasteners: Alloy fasteners with enhanced corrosion resistance, such as Hastelloy or Inconel, can be used in extremely corrosive environments.

Coated Fasteners: Coatings like zinc, galvanization, or epoxy can provide an extra layer of protection against corrosion.

2. **High-Temperature Environments:**

Heat-Resistant Alloys: Fasteners made from heat-resistant alloys like Inconel, Monel, or titanium are suitable for high-temperature applications.

Ceramic-Coated Fasteners: Ceramic coatings can provide thermal insulation and resistance to high temperatures.

Low-Temperature Environments:

3. **Low-Temperature Steel:** Certain types of steel, such as low-temperature carbon steels, are designed to maintain their toughness and strength in cold conditions.
4. **Vibrations and Dynamic Loads:**

Locknuts: Nylon insert locknuts or prevailing torque locknuts are designed to resist loosening due to vibrations.

Thread Locking Compounds: Using thread-locking compounds can prevent fasteners from coming loose in dynamic environments.

5. **Wet or Humid Environments:**

Stainless Steel: Stainless steel is resistant to water and humidity-related corrosion.

Galvanized Fasteners: Galvanized coatings provide protection against moisture and humidity.

6. **Outdoor and Atmospheric Exposure:**

Weathering Steel: Weathering steel, also known as COR-TEN steel, forms a protective rust layer over time, making it suitable for outdoor applications.

Coated Fasteners: Coatings like zinc, powder coating, or paint can protect against atmospheric exposure.

7. **Chemical Exposure:**

Chemically Resistant Alloys: Fasteners made from materials like titanium or certain nickel alloys can resist chemical corrosion.

Plastic or Composite Fasteners: In chemically aggressive environments, plastic or composite fasteners might be suitable.

8. **Electrical Conductivity:**

Copper or Brass: Copper or brass fasteners can be used when electrical conductivity is required.

9. **Hygienic Environments (Food, Pharmaceuticals):**

Stainless Steel: Stainless steel fasteners are often used in hygienic environments due to their corrosion resistance and ease of cleaning.

10. **Aesthetic Considerations:**

Finishing Options: Fasteners can be chosen based on their appearance, with options for polished, painted, or coated finishes.

It's important to consult industry standards, guidelines, and experts when selecting fasteners for specific environments. Factors such as the expected temperature range, exposure to specific chemicals, and mechanical loads should all be taken into account to ensure the chosen fasteners perform as expected in the given conditions.

TEFLON IN THE FASTENER INDUSTRY

Teflon, a brand name for polytetrafluoroethylene (PTFE), is a synthetic fluoropolymer with a range of unique properties that make it highly valuable in various industries, including the fastener industry. Here are some of the key reasons for its importance in the fastener industry:

1. **Low Friction**: Teflon has an extremely low coefficient of friction, which means that it offers excellent lubrication properties. When used as a coating on fasteners, it reduces the friction between the fastener and the mating surface. This is particularly important in applications where fasteners need to be tightened or loosened repeatedly, as it reduces wear and tear on the fasteners and the components they connect.
2. **Corrosion Resistance**: Teflon is highly resistant to chemicals and corrosion. When applied as a coating on fasteners, it forms a protective barrier that helps prevent corrosion and rusting. This is crucial in environments where fasteners are exposed to moisture, chemicals, or other corrosive substances.
3. **Chemical Inertness**: Teflon is chemically inert and does not react with most chemicals and solvents. This property is advantageous when fasteners are used in industries or applications where they might come into contact with aggressive chemicals or substances that could degrade traditional fastener materials.
4. **Temperature Resistance**: Teflon can withstand a wide range of temperatures, from extremely low to high temperatures. This makes it suitable for applications where fasteners are exposed to varying temperature conditions without losing their mechanical properties or functional integrity.
5. **Non-Stick Properties**: Teflon has non-stick properties, which means that it resists the buildup of adhesives, glues, and other substances. In the fastener industry, this property is important for preventing fasteners from getting stuck due to adhesive or gummy materials.

6. **Electrical Insulation**: Teflon is an excellent electrical insulator. In situations where fasteners are used in electrical or electronic applications, applying a Teflon coating can help prevent electrical conductivity and short circuits.
7. **Easy Cleanup**: Teflon-coated fasteners are easier to clean and maintain due to their non-stick and resistant properties. This is particularly beneficial in industries where cleanliness and hygiene are essential, such as the food processing or pharmaceutical industries.

In summary, Teflon coatings provide a range of beneficial properties for fasteners in terms of reducing friction, preventing corrosion, resisting chemicals, and offering thermal stability. These characteristics extend the lifespan of fasteners and improve their performance in various industrial applications, making Teflon an important material in the fastener industry.

What applications in securing fasteners are best suited for Teflon?

Teflon coatings are particularly well-suited for securing fasteners in various applications where the unique properties of Teflon can provide significant advantages. Here are some applications in the fastener industry where Teflon coatings are commonly used:

1. **Automotive Industry**: Teflon-coated fasteners are used in the automotive industry for various components, such as engine parts, brake systems, and suspension components. The low friction and corrosion-resistant properties of Teflon help prevent fasteners from seizing, especially in high-temperature and harsh environments.
2. **Aerospace Industry**: In aerospace applications, Teflon-coated fasteners are used to secure components on aircraft, spacecraft, and satellites. The corrosion resistance and temperature stability of Teflon make it ideal for

withstanding the extreme conditions encountered in aerospace environments.

3. **Chemical and Petrochemical Industries**: Fasteners used in chemical processing plants and refineries are exposed to corrosive chemicals and aggressive environments. Teflon coatings protect fasteners from chemical degradation and rust, extending their lifespan in these challenging conditions.
4. **Food Processing and Pharmaceutical Industries**: These industries require strict adherence to hygiene and cleanliness standards. Teflon-coated fasteners are preferred in equipment used for food processing and pharmaceutical manufacturing due to their non-stick properties, ease of cleaning, and resistance to chemical cleaning agents.
5. **Medical Devices**: Teflon-coated fasteners are used in medical devices and equipment where biocompatibility, chemical resistance, and ease of sterilization are important. The non-reactive nature of Teflon makes it suitable for applications involving contact with bodily fluids and medical substances.
6. **Electronics and Electrical Equipment**: Teflon-coated fasteners are used in electronic devices and equipment where electrical insulation is crucial. The insulating properties of Teflon prevent short circuits and electrical interference, ensuring the reliable performance of sensitive electronic components.
7. **Marine Industry**: Fasteners used in marine environments are exposed to saltwater, which can cause corrosion. Teflon coatings provide effective protection against saltwater corrosion and extend the lifespan of fasteners used in marine applications.
8. **Industrial Machinery**: Teflon-coated fasteners are used in various industrial machinery and equipment where they are subject to repetitive movement and exposure to contaminants. The low friction of Teflon coatings reduces wear and tear on fasteners, helping maintain optimal equipment performance.

9. **HVAC (Heating, Ventilation, and Air Conditioning)**: Fasteners in HVAC systems are often subjected to temperature variations and moisture. Teflon coatings help prevent corrosion and binding, ensuring proper functioning of HVAC systems.
10. **Oil and Gas Industry**: Fasteners used in oil and gas exploration, production, and refining can be exposed to harsh conditions, including high temperatures and corrosive substances. Teflon coatings provide protection against corrosion and ensure the longevity of fasteners in these environments.

In these applications, Teflon coatings offer advantages such as reduced friction, corrosion resistance, chemical inertness, temperature stability, and non-stick properties. Choosing Teflon-coated fasteners can contribute to increased efficiency, reduced maintenance costs, and improved overall performance in various industrial sectors.

MAINTENANCE ON BLOWOUT PREVENTERS

Blowout preventers (BOPs) are critical safety components used in the oil and gas industry to prevent uncontrolled releases of hydrocarbons during drilling, completion, and production operations. Securing fasteners on blowout preventers is essential to maintain the integrity and reliability of these devices. Here are some general maintenance procedures required when securing fasteners on blowout preventers:

1. **Regular Inspections**: Conduct routine inspections of the blowout preventer to identify any loose or damaged fasteners. Visual and physical inspections should be performed to ensure all fasteners are properly secured and functioning as intended.
2. **Torque Checks**: Regularly check the torque (tightness) of fasteners as specified by the manufacturer's recommendations. Over time, vibrations, temperature fluctuations, and operational stress can cause fasteners to become loose. Follow the torque values provided by the manufacturer to ensure proper tension and prevent leakage.
3. **Use Proper Tools**: When checking and tightening fasteners, use the correct tools such as torque wrenches calibrated to the appropriate specifications. Using improper tools or excessive force can damage fasteners, leading to potential failures.
4. **Replace Damaged Fasteners**: If you find any damaged, corroded, or worn fasteners during inspections, replace them with new ones. It's important to use fasteners that meet the original specifications and material requirements.
5. **Bolt Stretch Measurement**: In some cases, bolt stretch measurement techniques may be used to determine the tension in critical fasteners. This can provide a more accurate way to ensure the fasteners are properly tightened.

6. **Thread Lubrication**: Depending on the specific design and materials of the fasteners, it may be necessary to apply thread lubrication to achieve accurate torque values. Follow manufacturer recommendations for lubrication type and amount.
7. **Record Keeping**: Maintain thorough records of maintenance activities, including torque values applied, replacement of fasteners, and inspection results. This documentation helps in tracking the maintenance history of the blowout preventer.
8. **Environmental Factors**: Consider the environmental conditions in which the blowout preventer operates. Exposure to harsh weather, saltwater, and corrosive chemicals can accelerate fastener deterioration. Regular maintenance and corrosion prevention measures are crucial in such environments.
9. **Manufacturer Guidelines**: Always refer to the manufacturer's maintenance guidelines and specifications for the specific blowout preventer model. Different designs and materials may require different maintenance approaches.
10. **Training and Certification**: Ensure that personnel responsible for blowout preventer maintenance are adequately trained and certified to perform the necessary tasks. Safety procedures and industry best practices should be followed at all times.
11. **Emergency Response Plan**: Have an emergency response plan in place in case of unexpected issues or failures. This plan should include steps to address fastener-related problems quickly and efficiently.

Remember that blowout preventers play a critical role in preventing catastrophic events in the oil and gas industry. Regular and proper maintenance of fasteners is essential to ensure their reliable and safe operation. Always prioritize safety and follow industry standards and regulations.

What tools are necessary to perform maintenance on blowout preventers?

Performing maintenance on blowout preventers (BOPs) requires a range of specialized tools to ensure that the equipment is inspected, maintained, and repaired effectively and safely. The specific tools needed can vary based on the type of BOP and the maintenance tasks being performed. Here are some common tools that are typically necessary for BOP maintenance:

1. **Torque Wrenches**: Torque wrenches are used to apply precise torque values to fasteners during installation and maintenance. They ensure that fasteners are tightened to the correct specifications to prevent leakage and maintain the integrity of the BOP.
2. **Bolt Tensioning Tools**: These tools are used to measure and adjust the tension of fasteners accurately. They are particularly useful for ensuring proper tension in critical components of the BOP.
3. **Hydraulic Power Units**: Hydraulic power units provide the necessary hydraulic pressure to operate various components of the BOP, such as rams and valves. These units are essential for testing and ensuring the proper functioning of hydraulic systems.
4. **Flange Spreader Tools**: Flange spreader tools are used to separate and create space between flanges, making it easier to perform maintenance on gaskets, seals, and other components.
5. **Gasket Cutting Tools**: Gasket cutting tools are used to create custom gaskets for sealing joints and connections within the BOP.
6. **Bearing Pullers**: Bearing pullers are used to remove bearings and other rotating components for inspection and replacement.
7. **Pipe Handling Tools**: These tools assist in handling and positioning pipes and other components during maintenance and assembly processes.
8. **Wrenches and Sockets**: Standard wrenches and sockets are essential for removing and tightening bolts, nuts, and other fasteners.
9. **Pressure Gauges and Test Equipment**: Pressure gauges and testing equipment are used to verify the pressure integrity of the BOP and associated hydraulic systems.

10. **Inspection Tools**: Various inspection tools, such as borescopes, ultrasonic testers, and magnetic particle inspection tools, are used to assess the condition of internal components, detect defects, and ensure structural integrity.
11. **Lubrication Equipment**: Appropriate lubrication is crucial for the smooth operation of moving parts. Lubrication tools such as grease guns are used to apply lubricants to bearings and other components.
12. **Cranes and Lifting Equipment**: BOP components can be heavy and cumbersome. Cranes and lifting equipment are necessary for safely lifting and positioning large components during maintenance and assembly.
13. **Sealant and Gasket Installation Tools**: Tools for applying sealants, adhesives, and gaskets are necessary for ensuring proper seals and preventing leaks.
14. **Safety Equipment**: Personal protective equipment (PPE), such as helmets, gloves, goggles, and appropriate clothing, is essential to ensure the safety of maintenance personnel.
15. **Documentation and Recording Tools**: Tools for documenting maintenance activities, such as cameras, tablets, and logbooks, are important for keeping accurate records.

It's important to note that the specific tools required can vary depending on the type of BOP, its manufacturer, and the maintenance tasks being performed. Maintenance personnel should receive proper training on the correct usage of these tools and follow industry best practices to ensure the safety and effectiveness of maintenance operations.

What safety issues should be considered when doing maintenance on blowout preventers?

Maintenance on blowout preventers (BOPs) involves working with complex equipment in potentially hazardous environments. Safety is paramount to prevent accidents, injuries, and equipment damage. Here are some key safety issues that should be considered when performing maintenance on blowout preventers:

1. **Personal Protective Equipment (PPE)**: Ensure that all personnel involved in BOP maintenance wear appropriate PPE, including helmets, gloves, eye protection, hearing protection, and clothing suitable for the working environment. Specialized flame-resistant clothing may be required, especially in high-temperature areas.
2. **Lockout/Tagout Procedures**: Implement lockout/tagout procedures to isolate energy sources and prevent accidental activation of hydraulic, electrical, or mechanical systems during maintenance. This helps prevent unexpected movement or releases that could cause injury.
3. **Confined Spaces**: Some BOP components may be located in confined spaces. Ensure that proper confined space entry procedures are followed, including ventilation, monitoring for hazardous gases, and having a rescue plan in place.
4. **Hydraulic Systems**: Hydraulic systems are common in BOPs. Be aware of the potential for high-pressure leaks, and follow proper procedures for depressurization, bleeding, and maintenance of hydraulic systems.
5. **Lifting and Rigging**: When handling heavy components or using lifting equipment, adhere to proper lifting and rigging practices. Ensure that equipment is rated for the load, and avoid working under suspended loads.
6. **Fall Prevention**: Use fall protection equipment, such as harnesses and safety lines, when working at heights, such as on elevated platforms or BOP stacks.
7. **Chemical Hazards**: Be aware of the presence of hazardous chemicals, such as hydraulic fluids and lubricants. Follow proper handling, storage, and disposal procedures to prevent exposure.
8. **Fire and Explosion Hazards**: BOPs are often located in areas where flammable gases or liquids are present. Follow proper procedures for

working in potentially explosive atmospheres, including the use of intrinsically safe tools and equipment.

9. **Hot Surfaces**: BOP components, especially in high-temperature environments, can become extremely hot. Take precautions to avoid burns and heat-related injuries.
10. **Machine Guarding**: Ensure that moving parts and components are properly guarded to prevent accidental contact. Follow established procedures for accessing and working on machinery.
11. **Communication and Coordination**: Maintain clear communication with all personnel involved in the maintenance work. Establish a communication protocol to ensure that everyone is aware of their roles and the status of the work.
12. **Emergency Procedures**: Have well-defined emergency procedures in place, including evacuation routes, assembly points, and methods of communication in case of accidents or incidents.
13. **Training and Competency**: Ensure that maintenance personnel are adequately trained and competent to perform their tasks safely. Provide training specific to BOPs, their components, and the associated hazards.
14. **Tool Safety**: Properly use and maintain tools to prevent accidents caused by tool failure or misuse. Ensure that tools are in good condition and calibrated as needed.
15. **Documentation and Records**: Maintain detailed records of maintenance activities, inspections, and safety measures. These records can be valuable for future reference and continuous improvement.
16. **Risk Assessment**: Conduct a thorough risk assessment before starting any maintenance work. Identify potential hazards, evaluate the risks, and implement appropriate controls to mitigate those risks.

By addressing these safety issues and following industry best practices, you can help ensure the well-being of personnel and the proper maintenance of blowout preventers while minimizing the risks associated with the work.

How many types of blowout preventers are in the marketplace, and what are their differences?

Blowout preventers (BOPs) are critical safety devices used in the oil and gas industry to prevent uncontrolled releases of hydrocarbons during drilling, completion, and production operations. There are several types of BOPs available in the marketplace, each with its own design and functionality. The main types of blowout preventers include:

1. **Annular BOP (Ram-Type Annular BOP)**:
   - An annular BOP consists of a large, doughnut-shaped rubber element (the annular preventer) that is hydraulically expanded to seal off the wellbore.
   - It is versatile and can seal around various sizes and shapes of pipes and tools entering the wellbore.
   - Used primarily for well control during drilling and completion operations.
2. **Ram-Type BOP**:
   - Ram-type BOPs use pairs of steel blocks (rams) that close vertically or horizontally to seal off the wellbore around a specific size of pipe or tool.
   - There are different types of ram configurations: pipe rams (for sealing around pipes), blind rams (for completely closing off the well), shear rams (for cutting and sealing pipes), and variable bore rams (for sealing various pipe sizes).
   - Ram-type BOPs are commonly used in well control situations and for sealing off the well in emergencies.
3. **Hybrid BOP (Combination BOP)**:
   - A hybrid BOP combines features of both annular and ram-type BOPs, providing the advantages of both sealing mechanisms.
   - It has an annular element as well as sets of ram blocks for various pipe sizes.
   - Hybrid BOPs offer flexibility and redundancy in sealing options.

4. **Stripper BOP**:
    - Stripper BOPs are used to seal around the drill pipe or tubing while allowing it to move up and down through the BOP stack.
    - They are commonly used in well servicing operations and workovers.
5. **Spherical BOP**:
    - A spherical BOP uses a large spherical element to seal around pipes and tools entering the wellbore.
    - It provides a large sealing surface and is particularly suitable for high-pressure applications.
6. **Control Systems and Accumulators**:
    - While not traditional BOPs, control systems and accumulators are crucial components of BOP stacks. They provide hydraulic power to operate the BOPs, control the opening and closing of rams, and maintain well control.

The choice of BOP type depends on factors such as the specific well configuration, drilling or production operations, pressure and temperature conditions, regulatory requirements, and safety considerations. BOPs are typically stacked in a sequence on top of the wellhead to provide redundancy and multiple barriers against potential blowouts.

It's important to note that advancements and variations in BOP designs continue to occur as technology evolves and safety standards are updated. Each type of BOP serves a specific purpose and addresses particular operational challenges, helping to maintain well integrity and prevent blowouts.

MAINTANENCE PROCEDURES

FOR INDUSTRIAL HEAT EXCHANGERS

Maintenance procedures for industrial heat exchangers are crucial to ensure their efficient and safe operation over their lifespan. Heat exchangers are used in various industries, including chemical processing, power generation, HVAC, and more. Here's a general overview of maintenance procedures for industrial heat exchangers:

1. **Regular Inspection:**
    - Perform routine visual inspections to identify signs of corrosion, leaks, fouling, and other issues.
    - Inspect gaskets, seals, and connections for wear and damage.
    - Check for signs of vibration, such as loose or damaged components.
2. **Cleaning:**
    - Clean the heat exchanger surfaces to remove fouling, scaling, and deposits that reduce heat transfer efficiency.
    - Use appropriate cleaning methods such as chemical cleaning, mechanical cleaning (brushes, scrapers), and high-pressure water or steam cleaning.
    - Use mild cleaning agents to avoid damaging heat exchanger materials.
3. **Fouling Prevention:**
    - Implement measures to reduce fouling, such as installing filters and strainers to capture debris before it reaches the heat exchanger.
    - Consider using additives that prevent scaling and fouling within the heat exchanger.
4. **Gasket and Seal Maintenance:**
    - Regularly inspect gaskets and seals for signs of wear, damage, or leakage.
    - Replace gaskets and seals as needed to prevent leaks and maintain proper sealing.

5. **Tube Inspection and Cleaning:**
    - Inspect the tubes for corrosion, pitting, and erosion.
    - Use methods like eddy current testing, ultrasonic testing, and visual inspection to assess tube condition.
    - Clean the inside of tubes using methods such as mechanical brushing, chemical cleaning, or high-pressure water.
6. **Fluid Quality Control:**
    - Maintain the quality of the fluids circulating through the heat exchanger, including proper chemical treatment to prevent corrosion and fouling.
    - Regularly analyze fluid samples to monitor its quality and identify any degradation.
7. **Vibration and Alignment:**
    - Regularly check for excessive vibration, misalignment, and worn-out supports or connections.
    - Address any issues promptly to prevent further damage and maintain stability.
8. **Corrosion Protection:**
    - Apply protective coatings or linings to prevent corrosion on the heat exchanger surfaces.
    - Consider cathodic protection methods, sacrificial anodes, or using corrosion-resistant materials.
9. **Emergency Shutdown Procedures:**
    - Have clear procedures in place for shutting down the heat exchanger in case of emergencies to prevent further damage and ensure the safety of personnel.
10. **Documentation and Record-Keeping:**
    - Maintain detailed records of maintenance activities, inspections, repairs, and any modifications.
    - Use this documentation to track the heat exchanger's performance over time and plan maintenance schedules.

Remember that the specific maintenance procedures can vary based on the type of heat exchanger (shell and tube, plate, finned-tube, etc.), the operating conditions, the fluids involved, and industry-specific requirements. It's essential to follow manufacturer guidelines, industry standards, and best practices for maintaining your specific heat exchanger effectively.

What type of fasteners are used in industrial heat exchangers?

Fasteners used in industrial heat exchangers are chosen based on factors such as the heat exchanger's design, materials, operating conditions, and the types of forces they need to withstand. Common types of fasteners used in industrial heat exchangers include:

1. **Bolts and Nuts:**
   - Hexagonal head bolts and matching nuts are commonly used for securing components in heat exchangers.
   - Bolts and nuts are available in various materials, such as carbon steel, stainless steel, and alloy steel, depending on the corrosion resistance required.
2. **Studs and Nuts:**
   - Studs are threaded rods without a head, designed to be installed into a threaded hole.
   - Studs are often used when the heat exchanger components are large and require precise alignment during assembly.
3. **Washers:**
   - Flat washers and spring washers are used under nuts or bolt heads to distribute the load, prevent loosening, and reduce friction between surfaces.
4. **Screws:**
   - Machine screws and self-tapping screws may be used to secure smaller components or to attach nameplates, tags, and labels.
5. **Threaded Rods:**
   - Threaded rods are often used for supporting components and providing a secure connection between different parts of the heat exchanger.

6. **Clamps and Fastening Systems:**
    - Clamps, brackets, and other fastening systems may be used to secure pipes, tubes, and other components within the heat exchanger.
7. **Expansion Joints and Flanges:**
    - Expansion joints allow for thermal expansion and contraction of pipes and tubes.
    - Flanges, which are flat plates with bolt holes, are used to connect pipes or tubes and provide easy access for maintenance.
8. **Retaining Rings and Circlips:**
    - These fasteners are used to secure bearings, shafts, and other rotating components within the heat exchanger.

When selecting fasteners for industrial heat exchangers, it's essential to consider factors such as:

- **Corrosion Resistance:** Choose fasteners made from materials that resist corrosion in the heat exchanger's operating environment.
- **Temperature and Pressure:** Ensure the selected fasteners can withstand the temperature and pressure conditions within the heat exchanger.
- **Compatibility:** Ensure the fasteners are compatible with the materials used in the heat exchanger's construction.
- **Vibration and Shock:** Consider the potential for vibration and shock loads and choose fasteners that can handle these forces.
- **Maintenance and Accessibility:** Select fasteners that allow for easy disassembly and reassembly during maintenance.

It's crucial to follow manufacturer recommendations and industry standards when selecting and installing fasteners for industrial heat exchangers to ensure safe and reliable operation.

When using fasteners such as Studs and Nuts involving industrial heat exchangers, what procedures are required for assembly and disassembly during maintenance?

Assembling and disassembling industrial heat exchangers involving studs and nuts requires careful procedures to ensure proper installation, maintenance, and reassembly. Here's a general outline of the procedures for assembling and disassembling heat exchangers using studs and nuts during maintenance:

Assembly:

1. **Preparation:**
    - Gather all necessary tools, equipment, and materials, including the appropriate studs, nuts, washers, and any required lubricants.
    - Ensure you have the correct specifications for the studs and nuts, including size, material, and threading.
2. **Surface Preparation:**
    - Ensure all surfaces where studs, nuts, and washers will be installed are clean, free from debris, and properly aligned.
    - Check for any signs of corrosion or damage that could affect the fastener's integrity.
3. **Stud Installation:**
    - Thread the studs into the threaded holes in one of the components being assembled. Use a calibrated torque wrench to ensure the studs are properly seated.
    - Apply an appropriate thread locking compound if required to prevent loosening due to vibration.
4. **Washer and Nut Installation:**
    - Place a washer over the stud and thread the nut onto the stud by hand until it's snug against the washer.
    - Use a calibrated torque wrench to tighten the nut to the manufacturer's recommended torque specification. Follow a proper tightening sequence if specified.
5. **Tightening Sequence:**
    - If a specific tightening sequence is recommended by the heat exchanger's manufacturer, follow it to ensure even and balanced force distribution.

6. **Torque Verification:**
    - After tightening all nuts, use the torque wrench to verify that each nut is torqued correctly, and there is uniform tension across the joint.
7. **Quality Control:**
    - Inspect the assembled components for proper alignment, even clamping force, and correct installation of washers and nuts.

Disassembly:

1. **Preparation:**
    - Similar to the assembly process, gather the necessary tools and equipment for disassembly.
2. **Nut Loosening:**
    - Use the appropriate tools to carefully loosen each nut from the studs while maintaining alignment and preventing damage to the threads.
3. **Washer and Nut Removal:**
    - Remove the nut and washer from each stud carefully to avoid damaging the threads.
4. **Stud Removal:**
    - Unscrew the studs from the threaded holes in the components being disassembled.
5. **Inspection:**
    - Inspect the studs, nuts, washers, and the threaded holes for wear, damage, and signs of corrosion.
6. **Replacement or Maintenance:**
    - Replace any damaged or worn studs, nuts, or washers as necessary.
    - If corrosion or damage is present, clean and treat the threaded holes before reassembly.
7. **Reassembly:**
    - Follow the assembly procedure outlined earlier, using new studs, nuts, and washers if required.

It's important to note that specific heat exchanger designs and manufacturer recommendations may dictate variations in assembly and disassembly procedures.

Always refer to the heat exchanger's documentation, manufacturer guidelines, and industry standards for the most accurate and up-to-date procedures.

What safety issues are there to consider when doing maintenance on industrial heat exchangers?

Maintenance on industrial heat exchangers presents several safety issues that must be carefully considered to protect personnel, equipment, and the environment. Here are some critical safety issues to address when performing maintenance on industrial heat exchangers:

1. **Hazardous Substances:**
    - Heat exchangers can contain hazardous substances, such as corrosive chemicals or flammable gases. Proper identification and handling of these substances are essential to prevent exposure and accidents.
2. **Confined Spaces:**
    - Some maintenance tasks may require access to confined spaces, such as within heat exchanger tubes or chambers. Confined space entry procedures must be followed, including proper ventilation, monitoring, and emergency rescue plans.
3. **High Temperatures and Pressure:**
    - Heat exchangers can operate at high temperatures and pressures. Proper isolation, lockout/tagout procedures, and use of personal protective equipment (PPE) are crucial to prevent burns and other injuries.
4. **Electrical Hazards:**
    - Electrical components may be present around heat exchangers. Ensure proper grounding, lockout/tagout of electrical systems, and the use of non-conductive tools when working near electrical equipment.
5. **Chemical Exposure:**

- Cleaning agents, corrosion inhibitors, and other chemicals used during maintenance can pose health risks. Workers should be trained in proper chemical handling, use of PPE, and ventilation.

6. **Falling Hazards:**
   - Elevated work platforms, ladders, and scaffolding may be necessary for maintenance tasks. Fall protection measures, such as guardrails and harnesses, should be used when working at heights.
7. **Moving Parts:**
   - Rotating machinery parts, fans, and motors are common in heat exchangers. Ensure all moving parts are properly locked out and tagged out before maintenance begins.
8. **Lifting and Rigging:**
   - Heavy components, such as heat exchanger tubes or headers, may require lifting and rigging equipment. Proper rigging techniques and load calculations are essential to prevent accidents.
9. **Vibration and Noise:**
   - Vibrating components and noisy environments can lead to discomfort and long-term health issues for workers. Use vibration-damping materials, hearing protection, and other measures to mitigate these risks.
10. **Personal Protective Equipment (PPE):**
    - Workers should wear appropriate PPE, including gloves, goggles, hard hats, respiratory protection, and heat-resistant clothing, based on the specific tasks and hazards.
11. **Emergency Response:**
    - Have clear emergency response plans in place for various scenarios, such as chemical spills, fires, or injuries. Conduct regular drills to ensure all personnel are familiar with the procedures.
12. **Training and Supervision:**
    - Workers should be adequately trained in heat exchanger maintenance procedures and safety protocols. Supervision and monitoring are important to ensure tasks are carried out safely.
13. **Communication:**

- Maintain clear communication among the maintenance team, including the use of radios, hand signals, and safety checks before starting work.

14. **Proper Tools and Equipment:**

- Ensure that the tools and equipment used for maintenance are in good condition and appropriate for the task at hand.

Prioritize safety by conducting thorough risk assessments, following industry standards and regulations, and involving experienced personnel. Regular safety training and continuous improvement of safety procedures are key to preventing accidents and ensuring a safe working environment during heat exchanger maintenance.

WHAT IS HOT BOLTING

Hot bolting refers to the process of replacing or tightening bolts on equipment, machinery, or piping systems while they are still in operation and at high temperatures. This technique is often used in industries such as petrochemical, power generation, and manufacturing, where shutting down the system for maintenance is not feasible due to production requirements. Hot bolting requires specialized tools and techniques to ensure safety and effectiveness in these challenging conditions.

What is the best procedure for hot bolting?

The procedure for hot bolting should prioritize safety and effectiveness. Here's a general outline of the steps involved:

1. **Safety Precautions**: Ensure proper training and protective gear for the personnel involved. Understand the risks associated with high temperatures, pressure, and confined spaces.
2. **Assessment**: Evaluate the need for hot bolting, considering factors like leakages, corrosion, or loss of integrity. Plan the scope of work and identify which bolts need replacement or tightening.
3. **Equipment Preparation**: Gather the necessary tools, including specialized high-temperature wrenches, extension bars, lubricants, and insulation materials. Ensure that all equipment is properly calibrated and in good working condition.
4. **Isolation and Depressurization**: If possible, isolate the section of the system being worked on to minimize exposure to high temperatures and pressure. Depressurize the system safely following proper procedures.
5. **Heat Shielding**: Install heat-resistant shields or blankets around the work area to protect personnel from the high temperatures.
6. **Cooling Period**: Allow the equipment to cool down slightly before starting the hot bolting process. This reduces the risk of burns and improves the accuracy of torque values.

7. **Bolt Removal/Replacement**: Carefully remove the old bolts using the appropriate tools. Replace them with new bolts as needed. Apply lubricants or anti-seize compounds to prevent corrosion and make future maintenance easier.
8. **Torque Application**: Use torque wrenches designed for high-temperature environments to tighten the bolts according to manufacturer specifications. Ensure uniform torque application to avoid stress concentration.
9. **Quality Checks**: Verify the proper torque values and alignment of the bolted connections. Inspect for any signs of leakage or misalignment.
10. **Insulation and Re-pressurization**: If applicable, reapply insulation materials to maintain temperature stability. Gradually re-pressurize the system while monitoring for leaks.
11. **Documentation**: Keep detailed records of the hot bolting procedure, including torque values, bolt replacements, and any anomalies encountered. This information is crucial for future maintenance and integrity assessments.
12. **Post-Procedure Evaluation**: After completing the hot bolting, monitor the system for a period to ensure that the newly bolted connections are functioning as intended and that there are no leaks or issues.

Remember that the specifics of the procedure may vary depending on the equipment, industry, and regulations in place. Always consult with experts who have experience in hot bolting for your particular application.

What errors should be avoided when hot bolting?

When performing hot bolting, several errors should be avoided to ensure the safety of personnel, the integrity of the equipment, and the effectiveness of the maintenance process. Here are some key errors to watch out for:

1. **Insufficient Safety Precautions**: Neglecting proper safety gear, training, and precautions can lead to serious injuries due to the high temperatures, pressure, and potential hazards involved.

2. **Inadequate Planning**: Failing to assess the scope of work, determine which bolts need attention, or adequately prepare for the procedure can result in inefficiencies and safety risks.
3. **Incorrect Torque Application**: Applying incorrect torque values or using improper torque wrenches can lead to uneven or inadequate bolt tightening, which can result in leaks, bolt failures, or compromised equipment integrity.
4. **Over-Torquing or Under-Torquing**: Applying too much or too little torque can both be problematic. Over-tightening can damage bolts or equipment, while under-tightening can lead to leaks and poor connections.
5. **Lack of Proper Tools and Equipment**: Using incorrect or substandard tools for hot bolting can lead to inaccurate torque application, delays in the procedure, or unsafe conditions.
6. **Inadequate Cooling Time**: Starting the bolting process too soon after equipment shutdown can result in burns, as the equipment may still be dangerously hot.
7. **Neglecting Thermal Expansion**: Not accounting for the thermal expansion of the equipment during hot bolting can result in improper alignment of bolted connections, leading to leaks or stress concentration.
8. **Improper Bolt Replacement**: Using incorrect or incompatible bolts during replacement can compromise the structural integrity of the system and lead to failures.
9. **Inaccurate Documentation**: Failing to document torque values, bolt replacements, and other relevant information can make it difficult to track maintenance history and assess the integrity of the system in the future.
10. **Ignoring Manufacturer Guidelines**: Neglecting manufacturer recommendations, guidelines, and specifications for hot bolting procedures can result in suboptimal maintenance outcomes and potential safety risks.
11. **Rushing the Process**: Hurrying through the hot bolting process without proper attention to detail can lead to mistakes, compromised connections, and safety hazards.
12. **Lack of Quality Control**: Not conducting thorough quality checks and inspections after hot bolting can lead to undetected issues that may become critical over time.

To avoid these errors, it's crucial to have experienced personnel who are knowledgeable about hot bolting techniques and to adhere to industry best practices and guidelines. When in doubt, consulting with experts in the field can help ensure a successful and safe hot bolting procedure.

SECURING FASTENERS – PRE-LOAD

In the context of securing fasteners, "pre-load" refers to the intentional application of a specific amount of axial force or tension to a fastener (such as a bolt or a screw) before it is tightened down to its final torque or clamp load. This tension applied to the fastener creates an initial compressive force on the joint or components being held together. The primary purpose of applying pre-load is to ensure that the joint remains securely fastened even under varying loads, vibrations, and external forces.

Here's how it works:

1. **Pre-Load Application**: Before fully tightening the fastener, a certain amount of force (pre-load) is applied by torquing or turning the fastener. This force creates tension in the fastener itself and compression in the components it's holding together.
2. **Joint Compression**: The pre-load force creates compression between the parts being fastened. This compression improves the friction between the mating surfaces and helps prevent any movement or separation of the components.
3. **Clamping Force**: As external loads or forces act on the joint, the initial tension (pre-load) helps counteract these forces.

The joint's resistance to these external forces is directly related to the initial pre-load applied to the fastener.

4. **Stress Distribution**: Proper pre-load helps distribute the load more evenly across the joint, reducing the risk of localized stress concentrations that could lead to failure or loosening of the fastener over time.
5. **Resilience to Vibrations**: In applications where there are vibrations or dynamic loads, the pre-load ensures that the fastener maintains its grip and the joint remains secure.

It's important to note that achieving the correct pre-load is critical to the joint's performance. Too little pre-load might lead to joint separation under external loads, while excessive pre-load can cause over-tightening, deformation, or even failure of the fastener or the components being fastened. Factors that influence the appropriate pre-load include the material properties of the fastener and the components, the intended operating conditions, and the type of fastening method used.

In engineering applications, pre-load is often specified as a percentage of the fastener's yield strength or a specific force value. It's a key consideration in designing and assembling structures and machines to ensure their integrity and longevity under various operational conditions.

TENSIONING

Tensioning refers to the process of applying force to a material, structure, or system in order to create tension or stretching. This is often done to achieve specific objectives, such as maintaining the stability, integrity, or performance of the object or system in question. Tensioning is commonly used in various fields, including engineering, construction, mechanics, and even art.

In engineering and construction, tensioning is frequently used to strengthen and stabilize structures like bridges, buildings, and dams. One common application is in the use of tensioned cables or rods to provide support and prevent sagging or deformation under load. For example, in the construction of a cable-stayed bridge, tensioning is employed to ensure that the cables are under the appropriate tension to bear the weight of the bridge deck.

In mechanics, tensioning can involve tightening screws, bolts, or other fasteners to ensure that mechanical components are securely held together. This is important for preventing components from becoming loose or separating, which could lead to functional issues or safety hazards.

Overall, tensioning plays a crucial role in various domains, helping to maintain stability, enhance performance, and achieve desired outcomes for a wide range of applications.

What is the best procedure to use when tensioning fasteners?

Tensioning fasteners, such as bolts and screws, is a critical process to ensure that mechanical components are securely held together. The proper procedure for tensioning fasteners varies depending on the specific application and the type of fastener being used. However, here are some general steps and guidelines to follow when tensioning fasteners:

1. **Choose the Right Fastener and Torque Specification:**

Select the appropriate type and size of fastener for the application. Refer to engineering specifications or guidelines for the recommended torque values for the specific fastener and material combination.

2. **Clean the Surfaces:**

Ensure that the mating surfaces of the components being fastened are clean and free from debris, rust, or other contaminants. Clean surfaces provide better contact and help achieve accurate tensioning.

3. **Apply Lubrication (if necessary):**

Some applications might require the use of lubrication to achieve consistent tensioning. Make sure to use the correct type and amount of lubricant as specified in the guidelines.

4. **Tighten Gradually and Evenly:**

Begin tightening the fastener gradually and evenly. Use a torque wrench or other appropriate tool to apply the torque specified in the guidelines. Avoid sudden jerks or over-tightening, as this can lead to uneven tension and potential damage.

5. **Use a Cross-Pattern:**

When tightening multiple fasteners on a component (e.g., in a circular pattern), follow a cross-pattern sequence. This helps distribute tension evenly and prevents warping or distortion of the component.

6. **Apply Torque in Stages:**

For larger fasteners or critical applications, consider tightening in multiple stages. Gradually increase the torque in predetermined increments, checking the tension using a torque wrench or other appropriate tool at each stage.

7. **Verify Tension:**

Use a torque wrench or a tension-measuring device to verify that the specified tension has been achieved. Some applications might require a specific level of tension rather than just torque.

8. **Record the Tightening Sequence:**

Maintain a record of the tightening sequence and the torque values applied to each fastener. This can be useful for future maintenance, adjustments, or troubleshooting.

9. Follow Manufacturer's Guidelines:

Always refer to the manufacturer's recommendations and guidelines for tensioning their specific fasteners. Different fasteners may have unique procedures or requirements.

Consider Preload and Relaxation:

Depending on the application, you might need to account for preload (initial tension) and relaxation (loss of tension over time) of the fastener. This is especially important in applications where maintaining consistent tension is critical.

It's important to note that tensioning procedures can vary significantly based on the specific industry, application, and type of fastener. Therefore, always consult relevant engineering specifications, manufacturer recommendations, and any industry standards applicable to your specific situation.

What are the errors to avoid when tensioning fasteners?

Tensioning fasteners is a critical process that, when done improperly, can lead to performance issues, safety hazards, or even catastrophic failures. Here are some common errors to avoid when tensioning fasteners:

1. **Over-Tightening:**

Applying excessive torque or tension beyond the recommended specifications can lead to thread stripping, deformation of components, or even the fastener breaking. This can weaken the joint and compromise its integrity.

2. **Under-Tightening:**

Failing to apply sufficient tension can result in loose connections, which can lead to components separating, vibration-induced fatigue, and reduced performance of the assembly.

3. **Uneven Tightening:**

Unevenly applying torque or tension to fasteners can cause uneven stress distribution across the joint. This can lead to distortion, warping, or localized failure of the components.

4. **Not Following Recommended Sequence:**

Neglecting to follow the specified tightening sequence, especially for multiple fasteners on a component, can lead to uneven tension distribution and affect the overall stability and performance of the assembly.

5. **Ignoring Manufacturer Guidelines:**

Failing to adhere to the manufacturer's recommendations for torque values, lubrication, and other important guidelines specific to the fastener can result in unreliable connections.

6. **Lack of Cleanliness:**

Applying fasteners to dirty, contaminated, or corroded surfaces can hinder proper contact and tension. Clean and prepare mating surfaces before tensioning.

7. **Incorrect Lubrication:**

Using the wrong type or amount of lubrication can lead to inaccurate torque readings and unpredictable tension levels.

8. **Improper Tool Usage:**

Using an incorrect torque wrench, not calibrating tools, or using worn-out tools can lead to inaccurate tensioning, potentially causing fastener failure.

9. **Not Accounting for Relaxation:**

Many fasteners experience a loss of tension over time due to factors like settling, thermal expansion, and material relaxation. Failing to account for this can result in joints becoming loose over time.

10. **Not Considering Preload:**

In applications where preloading (initial tension) is critical, not achieving the required preload can compromise the integrity and performance of the joint.

11. **Using Damaged Fasteners:**

Using fasteners with damaged threads or other defects can result in unreliable connections and decreased joint strength.

12. **Ignoring Environmental Factors:**

Environmental conditions such as temperature fluctuations, humidity, and corrosive substances can affect tension retention and joint integrity. These factors should be considered during tensioning.

13. **Guessing or "Feeling" Tightness:**

Relying on intuition to determine the appropriate tension is not accurate or reliable. Always use calibrated tools and follow recommended procedures.

14. **Not Documenting Tensioning Process:**

Failing to record the tightening sequence, torque values, and any deviations from standard procedures can make it difficult to troubleshoot or replicate the process in the future.

To avoid these errors, it's crucial to follow manufacturer guidelines, adhere to engineering specifications, and use appropriate tools and procedures for tensioning fasteners in each specific application.

What is the procedure for tensioning fasteners when using hydraulic tensioners?

Tensioning fasteners using hydraulic tensioners involves a specific procedure to ensure proper and consistent tension is applied to the fasteners, which is crucial for maintaining the integrity of the joint. Here's a general outline of the procedure:

1. Preparation:

Gather all the necessary equipment, including the hydraulic tensioners, hydraulic pump, hoses, pressure gauge, and appropriate fasteners.

Make sure the hydraulic system is in good working condition and properly calibrated.

Ensure the surfaces of the fastener components are clean and free from debris, rust, or contaminants.

2. Selection of Tensioners:

Choose the appropriate size and type of hydraulic tensioner for the fasteners you are working with. The tensioner should match the size and specifications of the fastener and joint being tensioned.

3. Mounting Tensioners:

Position the hydraulic tensioner over the fastener in the joint. Ensure that the load cell of the tensioner is aligned with the axis of the fastener.

If needed, apply lubrication to the threads of the fastener to minimize friction during tensioning.

4. Connecting Hydraulic System:

Connect the hydraulic pump to the tensioner using the appropriate hoses and fittings.

Ensure the connections are tight and leak-free to prevent pressure loss during tensioning.

5. Applying Tension:

Gradually operate the hydraulic pump to apply pressure to the tensioner. This will stretch the fastener and induce tension in the joint.

Use the pressure gauge to monitor the hydraulic pressure. Follow the manufacturer's recommended pressure values for the specific fastener and joint type.

6. Achieving Target Tension:

Continue applying pressure until the desired tension is achieved. This tension should be determined based on engineering specifications or guidelines, considering factors like material properties and joint requirements.

Some tensioners are equipped with indicators that show when the proper tension is reached, while others may require pressure readings to be compared against a tension chart.

7. Locking and Seating:

Once the desired tension is achieved, hold the tensioner in position and lock it to maintain the tension.

In some cases, you might need to use additional tools or methods to secure the fastener, such as jam nuts or locking devices.

8. Pressure Release and Removal:

Carefully release the pressure from the hydraulic pump and disconnect the hoses.

Double-check that the tensioner is properly secured and the fastener is in its intended position.

If applicable, recheck the tension after a certain time period to account for relaxation or settling of the joint.

9. Quality Control and Documentation:

Inspect the joint to ensure proper alignment and seating of the fasteners.

Keep detailed records of the tensioning process, including the applied pressure, time, date, and any observations.

10. Post-Tensioning Verification:

If feasible, perform tension verification tests using ultrasonic, magnetic, or other non-destructive testing methods to confirm the applied tension.

Remember that the procedure may vary depending on the specific type of hydraulic tensioner, the fastener and joint materials, and the engineering specifications. Always refer to the manufacturer's guidelines and the engineering standards relevant to your specific application.

What are any issues to avoid when tensioning fasteners with hydraulic tensioners?

Tensioning fasteners with hydraulic tensioners can be an effective method for achieving accurate and consistent tension in bolted joints. However, there are several issues and mistakes that should be avoided to ensure a successful tensioning process and maintain the integrity of the joint. Here are some key issues to watch out for:

1. Over-Tensioning or Under-Tensioning:

Applying too much tension can lead to fastener and joint damage, distortion, or failure.

Insufficient tension can result in loose joints, reduced load-bearing capacity, and joint separation.

2. Incorrect Tensioner Selection:

Using the wrong size or type of tensioner can lead to improper tension and compromised joint integrity.

Always select tensioners that match the specifications of the fastener and joint being tensioned.

3. Lack of Proper Calibration:

Hydraulic tensioners and pumps need to be properly calibrated to ensure accurate pressure readings and tensioning.

Failure to calibrate can lead to inaccurate tensioning and potential joint failure.

4. Inaccurate Pressure Readings:

Relying solely on pressure readings without considering the actual tension in the fastener can result in inaccurate tensioning.

Tensioners with load indicators or gauges directly measuring tension are preferred.

5. Inadequate Surface Preparation:

Dirty, rusted, or contaminated fastener surfaces can affect the accuracy of the tensioning process.

Clean and properly prepared surfaces are essential for achieving consistent tension.

6. Improper Lubrication:

Insufficient or excessive lubrication can affect the friction during tensioning, leading to inaccurate tension values.

Follow manufacturer recommendations for lubrication.

7. Ignoring Manufacturer Guidelines:

Each tensioner and fastener has specific usage guidelines provided by the manufacturer.

Ignoring these guidelines can lead to incorrect tensioning or equipment damage.

8. Uneven Loading:

Uneven pressure application or misalignment of the tensioner can lead to uneven loading on the fastener and joint.

Ensure the tensioner is properly aligned and evenly loaded.

9. Insufficient Verification:

Failing to verify tension after the initial application can lead to tension loss due to factors like relaxation or settling of the joint.

Periodic re-tensioning or tension verification is important.

10. Poor Record Keeping:

Keeping accurate records of tensioning procedures, pressure readings, and other relevant information is crucial for quality control and maintenance.

11. Inadequate Training:

Proper training is essential for operators to understand the tensioning process, equipment operation, and safety protocols.

Untrained operators can lead to errors and unsafe practices.

12. Ignoring Safety Measures:

Hydraulic tensioning involves high pressures that can be hazardous if not handled correctly.

Always follow safety guidelines, wear appropriate personal protective equipment, and use proper safety procedures.

13. Rushing the Process:

Tensioning should be done carefully and systematically. Rushing through the process can lead to errors and incorrect tensioning.

14. Disregarding Environmental Conditions:

Extreme temperatures, humidity, or other environmental factors can impact the tensioning process.

Consider these conditions and adjust the process accordingly.

By avoiding these common issues and following manufacturer guidelines and best practices, you can ensure a successful tensioning process and maintain the reliability of bolted joints.

TORQUING VS. TENSIONING

Torquing fasteners, which involves applying a specific amount of rotational force (torque) to tighten bolts, screws, and other fasteners, offers several advantages in various applications. Here are some of the key benefits:

1. **Consistency**: Torquing ensures that fasteners are tightened consistently to a specific level, reducing the risk of under-tightening or over-tightening. This helps maintain uniform clamping force across multiple fasteners, which is crucial for even distribution of load and preventing material distortion.
2. **Optimal Joint Integrity**: Properly torqued fasteners create a secure and reliable joint that resists loosening due to vibrations, thermal expansion/contraction, or external forces. This is especially important in critical applications where joint failure could lead to catastrophic consequences, such as in aerospace or automotive industries.
3. **Preventing Damage**: Over-tightening fasteners can cause damage to the fastener itself, the material being fastened, or surrounding components. Torque specifications help avoid excessive stress on these components, extending their lifespan and reducing the risk of premature failure.
4. **Conservation of Materials**: Proper torquing ensures that fasteners are tightened to the appropriate level, preventing the need for excessive force that might otherwise damage or distort the materials being fastened. This can be particularly important when working with sensitive or delicate materials.
5. **Ease of Maintenance**: When fasteners are torqued to the correct specifications, they are less likely to loosen over time. This reduces the need for frequent re-tightening or maintenance, saving time and resources in the long run.

6. **Uniform Load Distribution**: Accurate torque application helps distribute the clamping force evenly across the joint. This minimizes the risk of stress concentrations at specific points, which could lead to fatigue, cracking, or failure.
7. **Reduced Gasket Leakage**: In applications where gaskets are used, proper torquing ensures that the gasket is compressed evenly, minimizing the chances of leaks and maintaining a reliable seal.
8. **Safety**: Torquing fasteners to the correct specifications is crucial for ensuring the safety of structures, equipment, and systems. In critical applications like construction, automotive manufacturing, and industrial machinery, proper torquing contributes to the overall safety of workers and users.
9. **Quality Control**: Torque specifications are often part of quality control processes in manufacturing. By adhering to specific torque values, manufacturers can ensure consistent product quality and performance.
10. **Compliance with Standards**: Many industries have established standards and regulations that specify torque requirements for different types of fasteners and applications. Adhering to these standards is essential for meeting industry requirements and regulations.

It's important to note that while torquing offers many advantages, it's also critical to use the appropriate torque values as specified by the manufacturer or relevant standards. Over-torquing or under-torquing can lead to performance issues, joint failure, or other complications. Therefore, using proper tools, techniques, and torque specifications is essential for reaping these benefits effectively.

What is the difference between torquing and tensioning fasteners?

Torquing and tensioning are two different methods used to achieve the desired clamping force when fastening components together. While both methods aim to create a secure and reliable joint, they involve different approaches and have distinct advantages and limitations.

Torquing:

Torquing involves applying a specific amount of rotational force (torque) to the fastener, usually using a torque wrench. The torque value is typically specified by the manufacturer or industry standards.

The torque applied to the fastener generates a clamping force that compresses the components being fastened together. This clamping force holds the components in place and prevents them from moving relative to each other.

Torque values can vary based on factors such as the size of the fastener, the material being fastened, and the intended application. It's important to use the correct torque value to ensure proper joint integrity.

Advantages of torquing include its simplicity, ease of measurement, and the ability to achieve consistent results when done correctly. However, it might not always accurately represent the actual tension in the fastener due to factors like friction and material properties.

Tensioning:

Tensioning involves directly applying a known axial force (tension) to the fastener using specialized tools or equipment. This axial force generates clamping force by elongating the fastener, compressing the components being fastened.

Tensioning is particularly useful in applications where accurate and consistent clamping force is critical. It allows for precise control over the clamping force, regardless of factors like friction and material properties.

Tensioning can achieve more accurate and uniform load distribution across the joint compared to torquing, as it directly measures the force applied to the fastener.

Tensioning is commonly used in applications where joint integrity is paramount, such as in the construction of bridges, pressure vessels, and pipelines.

While tensioning offers greater accuracy in achieving the desired clamping force, it requires specialized equipment and training to ensure proper execution.

In summary, the primary difference between torquing and tensioning lies in how the clamping force is generated. Torquing relies on the rotational force applied to the fastener to achieve clamping force, while tensioning directly applies axial force to generate the clamping force. The choice between these methods depends on factors like the level of accuracy required, the specific application, the available tools and equipment, and the expertise of the individuals performing the fastening.

ANSI 150 - 2500

AMERICAN NATIONAL STANDARD FLANGE SPECIFICATIONS

	150			300			400			600		
PIPE SIZE	**BOLT DIA.**	**# OF BOLTS**	**HEAVY HEX A/F**	**BOLT DIA.**	**# OF BOLTS**	**HEAVY HEX A/F**	**BOLT DIA.**	**# OF BOLTS**	**HEAVY HEX A/F**	**BOLT DIA.**	**# OF BOLTS**	**HEAVY HEX A/F**
1/2	1/2	4	7/8	1/2	4	7/8	1/2	4	7/8	1/2	4	7/8
3/4	1/2	4	7/8	5/8	4	1-1/16	5/8	4	1-1/16	5/8	4	1-1/16
1	1/2	4	7/8	5/8	4	1-1/16	5/8	4	1-1/16	5/8	4	1-1/16
1-1/4	1/2	4	7/8	5/8	4	1-1/16	5/8	4	1-1/16	5/8	4	1-1/16
1-1/2	1/2	4	7/8	3/4	4	1-1/4	3/4	4	1-1/4	3/4	4	1-1/4
2	5/8	4	1-1/16	5/8	8	1-1/16	5/8	8	1-1/16	5/8	8	1-1/16
2-1/2	5/8	4	1-1/16	3/4	8	1-1/4	3/4	8	1-1/4	3/4	8	1-1/4
3	5/8	4	1-1/16	3/4	8	1-1/4	3/4	8	1-1/4	3/4	8	1-1/4
3-1/2	5/8	8	1-1/16	3/4	8	1-1/4	7/8	8	1-7/16	N/A	N/A	N/A
4	5/8	8	1-1/16	3/4	8	1-1/4	7/8	8	1-7/16	7/8	8	1-7/16
5	3/4	8	1-1/4	3/4	8	1-1/4	7/8	8	1-7/16	1	8	1-5/8
6	3/4	8	1-1/4	3/4	12	1-1/4	7/8	12	1-7/16	1	12	1-5/8
8	3/4	8	1-1/4	7/8	12	1-7/16	1	12	1-5/8	1-1/8	12	1-13/16
10	7/8	12	1-7/16	1	16	1-5/8	1-1/8	16	1-13/16	1-1/4	16	2
12	7/8	12	1-7/16	1-1/8	16	1-13/16	1-1/4	16	2	1-1/4	20	2
14	1	12	1-5/8	1-1/8	20	1-13/16	1-1/4	20	2	1-3/8	20	2-3/16
16	1	16	1-5/8	1-1/4	20	2	1-3/8	20	2-3/16	1-1/2	20	2-3/8
18	1-1/8	16	1-13/16	1-1/4	24	2	1-3/8	24	2-3/16	1-5/8	20	2-9/16
20	1-1/8	20	1-13/16	1-1/4	24	2	1-1/2	24	2-3/8	1-5/8	24	2-9/16
24	1-1/4	20	2	1-1/2	24	2-3/8	1-3/4	24	2-3/4	1-7/8	24	2-15/16

	900			1500			2500		
PIPE SIZE	**BOLT DIA.**	**# OF BOLTS**	**HEAVY HEX A/F**	**BOLT DIA.**	**# OF BOLTS**	**HEAVY HEX A/F**	**BOLT DIA.**	**# OF BOLTS**	**HEAVY HEX A/F**
1/2	3/4	4	1-1/4	3/4	4	1-1/4	3/4	4	1-1/4
3/4	3/4	4	1-1/4	3/4	4	1-1/4	3/4	4	1-1/4
1	7/8	4	1-7/16	7/8	4	1-7/16	7/8	4	1-7/16
1-1/4	7/8	4	1-7/16	7/8	4	1-7/16	1	4	1-5/8
1-1/2	1	4	1-5/8	1	4	1-5/8	1-1/8	4	1-13-16
2	7/8	8	1-7/16	7/8	8	1-7/16	1	8	1-5/8
2-1/2	1	8	1-5/8	1	8	1-5/8	1-1/8	8	1-13/16
3	7/8	8	1-7/16	1-1/8	8	1-13/16	1-1/4	8	2
3-1/2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	1-1/8	8	1-13/16	1-1/4	8	2	1-1/2	8	2-3/8
5	1-1/4	8	2	1-1/2	8	2-3/8	1-3/4	8	2-3/4
6	1-1/8	12	1-13/16	1-3/8	12	2-3/16	2	8	3-1/8
8	1-3/8	12	2-3/16	1-5/8	12	2-9/16	2	12	3-1/8
10	1-3/8	16	2-3/16	1-7/8	12	2-15/16	2-1/2	12	3-7/8
12	1-3/8	20	2-3/16	2	16	3-1/8	2-3/4	12	4-1/4
14	1-1/2	20	2-3/8	2-1/4	16	3-1/2	N/A	N/A	N/A
16	1-5/8	20	2-9/16	2-1/2	16	3-7/8	N/A	N/A	N/A
18	1-7/8	20	2-15/16	2-3/4	16	4-1/4	N/A	N/A	N/A
20	2	20	3-1/8	3	16	4-5/8	N/A	N/A	N/A
24	2-1/2	20	3-7/8	3-1/2	16	5-3/8	N/A	N/A	N/A

HYTORC

ANSI 150-900

AMERICAN NATIONAL STANDARD FLANGE SPECIFICATIONS

	150			300			400			600			900		
PIPE SIZE	**BOLT DIA.**	**# OF BOLTS**	**HEAVY HEX A/F**	**BOLT DIA.**	**# OF BOLTS**	**HEAVY HEX A/F**	**BOLT DIA.**	**# OF BOLTS**	**HEAVY HEX A/F**	**BOLT DIA.**	**# OF BOLTS**	**HEAVY HEX A/F**	**BOLT DIA.**	**# OF BOLTS**	**HEAVY HEX A/F**
26	1-1/4	24	2	1-5/8	28	2-9/16	1-3/4	28	2-3/4	1-7/8	28	2-15/16	2-3/4	20	4-1/4
28	1-1/4	28	2	1-5/8	28	2-9/16	1-7/8	28	2-15/16	2	28	3-1/8	3	20	4-5/8
30	1-1/4	28	2	1-3/4	28	2-3/4	2	28	3-1/8	2	28	3-1/8	3	20	4-5/8
32	1-1/2	28	2-3/8	1-7/8	28	2-15/16	2	28	3-1/8	2-1/4	28	3-1/2	3-1/4	20	5
34	1-1/2	32	2-3/8	1-7/8	28	2-15/16	2	28	3-1/8	2-1/4	28	3-1/2	3-1/2	20	5-3/8
36	1-1/2	32	2-3/8	2	32	3-1/8	2	32	3-1/8	2-1/2	28	3-7/8	3-1/2	20	5-3/8
38	1-1/2	32	2-3/8	1-1/2	32	2-3/8	1-3/4	32	2-3/4	2-1/4	28	3-1/2	3-1/2	20	5-3/8
40	1-1/2	36	2-3/8	1-5/8	32	2-9/16	1-7/8	32	2-15/16	2-1/4	32	3-1/2	3-1/2	24	5-3/8
42	1-1/2	36	2-3/8	1-5/8	32	2-9/16	1-7/8	32	2-15/16	2-1/2	28	3-7/8	3-1/2	24	5-3/8
44	1-1/2	40	2-3/8	1-3/4	32	2-3/4	2	32	3-1/8	2-1/2	32	3-7/8	3-3/4	24	5-3/4
46	1-1/2	40	2-3/8	1-7/8	28	2-15/16	2	36	3-1/8	2-1/2	32	3-7/8	4	24	6-1/8
48	1-1/2	44	2-3/8	1-7/8	32	2-15/16	2-1/4	28	3-1/2	2-3/4	32	4-1/4	4	24	6-1/8
50	1-3/4	44	2-3/4	2	32	3-1/8	2-1/4	32	3-1/2	3	28	4-5/8	N/A	N/A	N/A
52	1-3/4	44	2-3/4	2	32	3-1/8	2-1/4	32	3-1/2	3	32	4-5/8	N/A	N/A	N/A
54	1-3/4	44	2-3/4	2-1/4	28	3-1/2	2-1/2	28	3-7/8	3	32	4-5/8	N/A	N/A	N/A
56	1-3/4	48	2-3/4	2-1/4	28	3-1/2	2-1/2	32	3-7/8	3-1/4	32	5	N/A	N/A	N/A
58	1-3/4	48	2-3/4	2-1/4	32	3-1/2	2-1/2	32	3-7/8	3-1/4	32	5	N/A	N/A	N/A
60	1-3/4	52	2-3/4	2-1/4	32	3-1/2	2-5/8	32	4-1/16	3-1/2	28	5-3/8	N/A	N/A	N/A

ANSI 150B - 900B

AMERICAN NATIONAL STANDARD FLANGE SPECIFICATIONS

	150 B			300 B			400 B			600 B			900 B		
PIPE SIZE	BOLT DIA.	# OF BOLTS	HEAVY HEX A/F	BOLT DIA.	# OF BOLTS	HEAVY HEX A/F	BOLT DIA.	# OF BOLTS	HEAVY HEX A/F	BOLT DIA.	# OF BOLTS	HEAVY HEX A/F	BOLT DIA.	# OF BOLTS	HEAVY HEX A/F
26	3/4	36	1-1/4	1-1/4	32	2	1-3/8	28	2-3/16	1-5/8	28	2-9/16	2-1/2	20	3-7/8
28	3/4	40	1-1/4	1-1/4	36	2	1-1/2	24	2-3/8	1-3/4	28	2-3/4	2-3/4	20	4-1/4
30	3/4	44	1-1/4	1-3/8	36	2-3/16	1-1/2	28	2-3/8	1-7/8	28	2-15/16	3	20	4-5/8
32	3/4	48	1-1/4	1-1/2	32	2-3/8	1-5/8	28	2-9/16	2	28	3-1/8	3	20	4-5/8
34	7/8	40	1-7/16	1-1/2	36	2-3/8	1-5/8	32	2-9/16	2-1/4	24	3-1/2	3-1/4	20	5
36	7/8	44	1-7/16	1-5/8	32	2-9/16	1-3/4	28	2-3/4	2-1/4	28	3-1/2	3	24	4-5/8
38	1	40	1-5/8	1-5/8	36	2-9/16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
40	1	44	1-5/8	1-5/8	40	2-9/16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
42	1	48	1-5/8	1-3/4	36	2-3/4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
44	1	52	1-5/8	1-3/4	40	2-3/4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
46	1-1/8	40	1-13/16	1-7/8	36	2-15/16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
48	1-1/8	44	1-13/16	1-7/8	40	2-15/16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
50	1-1/8	48	1-13/16	1-7/8	44	2-15/16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
52	1-1/8	52	1-13/16	1-7/8	48	2-15/16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
54	1-1/8	56	1-13/16	1-7/8	48	2-15/16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
56	1-1/8	60	1-13/16	2-1/4	36	3-1/2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
58	1-1/4	48	2	2-1/4	40	3-1/2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
60	1-1/4	52	2	2-1/4	40	3-1/2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

HYTORC

ANSI/ASME Series Flanges

FLANGE SIZE INCHES	FLANGE CLASS																	
	150			300			600			900			1500			2500		
	#	Bolt	Nut	#	Bolt	Nut	#	Bolt	Nut	#	Bolt	Nut	#	Bolt	Nut	#	Bolt	Nut
1/2"	4	1/2"	7/8"	4	1/2"	7/8"	4	1/2"	7/8"	4	3/4"	1 1/4"	4	3/4"	1 1/4"	4	3/4"	1 1/4"
3/4"	4	1/2"	7/8"	4	5/8"	1 1/16"	4	5/8"	1 1/16"	4	3/4"	1 1/4"	4	3/4"	1 1/4"	4	3/4"	1 1/4"
1"	4	1/2"	7/8"	4	5/8"	1 1/16"	4	5/8"	1 1/16"	4	7/8"	1 7/16"	4	7/8"	1 7/16"	4	7/8"	1 7/16"
1 1/4"	4	1/2"	7/8"	4	5/8"	1 1/16"	4	5/8"	1 1/16"	4	7/8"	1 7/16"	4	7/8"	1 7/16"	4	1"	1 5/8"
1 1/2"	4	1/2"	7/8"	4	3/4"	1 1/4"	4	3/4"	1 1/4"	4	1"	1 5/8"	4	1"	1 5/8"	4	1 1/8"	1 13/16"
2"	4	5/8"	1 1/16"	8	5/8"	1 1/16"	8	5/8"	1 1/16"	8	7/8"	1 7/16"	8	7/8"	1 7/16"	8	1"	1 5/8"
2 1/2"	4	5/8"	1 1/16"	8	3/4"	1 1/4"	8	3/4"	1 1/4"	8	1"	1 5/8"	8	1"	1 5/8"	8	1 1/8"	1 13/16"
3"	4	5/8"	1 1/16"	8	3/4"	1 1/4"	8	3/4"	1 1/4"	8	7/8"	1 7/16"	8	1 1/8"	1 13/16"	8	1 1/4"	2"
4"	8	5/8"	1 1/16"	8	3/4"	1 1/4"	8	7/8"	1 7/16"	8	1 1/8"	1 13/16"	8	1 1/4"	2"	8	1 1/2"	2 3/8"
5"	8	3/4"	1 1/4"	8	3/4"	1 1/4"	8	1"	1 5/8"	8	1 1/4"	2"	8	1 1/2"	2 3/8"	8	1 3/4"	2 3/4"
6"	8	3/4"	1 1/4"	12	3/4"	1 1/4"	12	1"	1 5/8"	12	1 1/8"	1 13/16"	12	1 3/8"	2 3/16"	8	2"	3 1/8"
8"	8	3/4"	1 1/4"	12	7/8"	1 7/16"	12	1 1/8"	1 13/16"	12	1 3/8"	2 3/16"	12	1 5/8"	2 9/16"	12	2"	3 1/8"
10"	12	7/8"	1 7/16"	16	1"	1 5/8"	16	1 1/4"	2"	16	1 3/8"	2 3/16"	12	1 7/8"	2 15/16"	12	2 1/2"	3 7/8"
12"	12	7/8"	1 7/16"	16	1 1/8"	1 13/16"	20	1 1/4"	2"	20	1 3/8"	2 3/16"	16	2"	3 1/8"	12	2 3/4"	4 1/4"
14"	12	1"	1 5/8"	20	1 1/8"	1 13/16"	20	1 3/8"	2 3/16"	20	1 1/2"	2 3/8"	16	2 1/4"	3 1/2"			
16"	16	1"	1 5/8"	20	1 1/4"	2"	20	1 1/2"	2 3/8"	20	1 5/8"	2 9/16"	16	2 1/2"	3 7/8"			
18"	16	1 1/8"	1 13/16"	24	1 1/4"	2"	20	1 5/8"	2 9/16"	20	1 7/8"	2 15/16"	16	2 3/4"	4 1/4"			
20"	20	1 1/8"	1 13/16"	24	1 1/4"	2"	24	1 5/8"	2 9/16"	20	2"	3 1/8"	16	3"	4 5/8"			
24"	20	1 1/4"	2"	24	1 1/2"	2 3/8"	24	1 7/8"	2 15/16"	20	2 1/2"	3 7/8"	16	3 1/2"	5 3/8"			
26"	24	1 1/4"	2"	28	1 5/8"	2 9/16"	24	2"	3 1/8"	20	2 3/4"	4 1/4"						
28"	28	1 1/4"	2"	28	1 5/8"	2 9/16"	28	2"	3 1/8"	20	3"	4 5/8"						
30"	28	1 1/4"	2"	28	1 3/4"	2 3/4"	28	2"	3 1/8"	20	3"	4 5/8"						
32"	28	1 1/2"	2 3/8"	28	1 7/8"	2 15/16"	28	2 1/4"	3 1/2"	20	3 1/4"	5"						
34"	32	1 1/2"	2 3/8"	28	1 7/8"	2 15/16"	28	2 1/4"	3 1/2"	20	3 1/2"	5 3/8"						
36"	32	1 1/2"	2 3/8"	32	2"	3 1/8"	28	2 1/2"	3 7/8"	20	3 1/2"	5 3/8"						

HYTORC

API 6A SPEC FLANGE BOLT NUT CHART

API Pressure Rating	Flange Size & Bore	Stud Size	Nut Size A.F.	API Torque $f = 0.07$	API Torque $f = 0.13$
2000 lb	2 1/16"	5/8"	1 1/16"	68	115
	2 9/16"	3/4"	1 1/4"	118	200
	3 1/8"	3/4"	1 1/4"	118	200
	4 1/16"	7/8"	1 7/16"	188	319
	5 1/8"	1"	1 5/8"	279	474
	7 1/16"	1"	1 5/8"	279	474
	9"	1 1/8"	1 13/16"	401	686
	11"	1 1/4"	2"	553	953
	13 5/8"	1 1/4"	2"	553	953
	16 3/4"	1 1/2"	2 3/8"	962	1677
	21 1/4"	1 5/8"	2 9/16"	1226	2146
	26 3/4"	1 3/4"	2 3/4"	1534	2696

API Pressure Rating	Flange Size & Bore	Stud Size	Nut Size A.F.	API Torque $f = 0.07$	API Torque $f = 0.13$
3000 lb	2 1/16"	7/8"	1 7/16"	188	319
	2 9/16"	1"	1 5/8"	279	474
	3 1/8"	7/8"	1 7/16"	188	319
	4 1/16"	1 1/8"	1 13/16"	401	686
	5 1/8"	1 1/4"	2"	553	953
	7 1/16"	1 1/8"	1 13/16"	401	686
	9"	1 3/8"	2 3/16"	739	1281
	11"	1 3/8"	2 3/16"	739	1281
	13 5/8"	1 3/8"	2 3/16"	739	1281
	16 3/4"	1 5/8"	2 9/16"	1226	2146
	20 3/4"	2"	3 1/8"	2297	4061
	26 3/4"	2"	3 1/8"	2297	4061

API Pressure Rating	Flange Size & Bore	Stud Size	Nut Size A.F.	API Torque $f = 0.07$	API Torque $f = 0.13$
5000 lb	2 1/16"	7/8"	1 7/16"	188	319
	2 9/16"	1"	1 5/8"	279	474
	3 1/8"	1 1/8"	1 13/16"	401	686
	4 1/16"	1 1/4"	2"	553	953
	5 1/8"	1 1/2"	2 3/8"	962	1677
	7 1/16"	1 3/8"	2 3/16"	739	1281
	9"	1 5/8"	2 9/16"	1226	2146
	11"	1 7/8"	2 15/16"	1890	3332
	13 5/8"	1 5/8"	2 9/16"	1226	2146
	16 3/4"	1 7/8"	2 15/16"	1890	3332
	18 3/4"	2"	3 1/8"	2297	4061
	21 1/4"	2"	3 1/8"	2297	4061

API Pressure Rating	Flange Size & Bore	Stud Size	Nut Size A.F.	API Torque $f = 0.07$	API Torque $f = 0.13$
10000 lb	1 13/16"	3/4"	1 1/4"	118	200
	2 1/16"	3/4"	1 1/4"	118	200
	2 9/16"	7/8"	1 7/16"	188	319
	3 1/16"	1"	1 5/8"	279	474
	4 1/16"	1 1/8"	1 13/16"	401	686
	5 1/8"	1 1/8"	1 13/16"	401	686
	7 1/16"	1 1/2"	2 3/8"	962	1677
	9"	1 1/2"	2 3/8"	962	1677
	11"	1 3/4"	2 3/4"	1534	2696
	13 5/8"	1 7/8"	2 15/16"	1890	3332
	16 3/4"	1 7/8"	2 15/16"	1890	3332
	18 3/4"	2 1/4"	3 1/2"	3276	5822
	21 1/4"	2 1/2"	3 7/8"	4500	8030

API Pressure Rating	Flange Size & Bore	Stud Size	Nut Size A.F.	API Torque $f = 0.07$	API Torque $f = 0.13$
15000 lb	1 13/16"	7/8"	1 7/16"	188	319
	2 1/16"	7/8"	1 7/16"	188	319
	2 9/16"	1"	1 5/8"	279	474
	3 1/16"	1 1/8"	1 13/16"	401	686
	4 1/16"	1 3/8"	2 3/16"	739	1281
	5 1/8"	1 1/2"	2 3/8"	962	1677
	7 1/16"	1 1/2"	2 3/8"	962	1677
	9"	1 7/8"	2 15/16"	1890	3332
	11"	2"	3 1/8"	2297	4061
	13 5/8"	2 1/4"	3 1/2"	3276	5822
	18 3/4"	3"	4 5/8"	7047	12654

API Pressure Rating	Flange Size & Bore	Stud Size	Nut Size A.F.	API Torque $f = 0.07$	API Torque $f = 0.13$
20000 lb	1 13/16"	1"	1 5/8"	279	474
	2 1/16"	1 1/8"	1 13/16"	401	686
	2 9/16"	1 1/4"	2"	553	953
	3 1/16"	1 3/8"	2 3/16"	739	1281
	4 1/16"	1 3/4"	2 3/4"	1534	2696
	7 1/16"	2"	3 1/8"	2297	4061
	9"	2 1/2"	3 7/8"	4500	8030
	11"	2 3/4"	4 1/4"	5424	9712
	13 5/8"	3"	4 5/8"	7047	12654

HYTORC

NM TO FT. LBS. CONVERSIONS

FT. LBS.	Factor	NM	FT. LBS.	Factor	NM
0.737	0.737	**1**	**4127.2**	0.737	**5600**
1.474	0.737	**2**	**4422**	0.737	**6000**
2.211	0.737	**3**	**4716.8**	0.737	**6400**
2.948	0.737	**4**	**5011.6**	0.737	**6800**
3.685	0.737	**5**	**5306.4**	0.737	**7200**
4.422	0.737	**6**	**5601.2**	0.737	**7600**
5.159	0.737	**7**	**5896**	0.737	**8000**
5.896	0.737	**8**	**6927.8**	0.737	**9400**
6.633	0.737	**9**	**7222.6**	0.737	**9800**
7.37	0.737	**10**	**7517.4**	0.737	**10200**
14.74	0.737	**20**	**7959.6**	0.737	**10800**
22.11	0.737	**30**	**8401.8**	0.737	**11400**
29.48	0.737	**40**	**8844**	0.737	**12000**
36.85	0.737	**50**	**9286.2**	0.737	**12600**
44.22	0.737	**60**	**9728.4**	0.737	**13200**
51.59	0.737	**70**	**10170.6**	0.737	**13800**
58.96	0.737	**80**	**10612.8**	0.737	**14400**
66.33	0.737	**90**	**11055**	0.737	**15000**
73.7	0.737	**100**	**11644.6**	0.737	**15800**
147.4	0.737	**200**	**12234.2**	0.737	**16600**
221.1	0.737	**300**	**12823.8**	0.737	**17400**
294.8	0.737	**400**	**13413.4**	0.737	**18200**
368.5	0.737	**500**	**14003**	0.737	**19000**
442.2	0.737	**600**	**14740**	0.737	**20000**
515.9	0.737	**700**	**15477**	0.737	**21000**
589.6	0.737	**800**	**16214**	0.737	**22000**
663.3	0.737	**900**	**16951**	0.737	**23000**
737	0.737	**1000**	**17688**	0.737	**24000**
884.4	0.737	**1200**	**18425**	0.737	**25000**
1031.8	0.737	**1400**	**19162**	0.737	**26000**
1179.2	0.737	**1600**	**19899**	0.737	**27000**
1326.6	0.737	**1800**	**20636**	0.737	**28000**
1474	0.737	**2000**	**21373**	0.737	**29000**
1621.4	0.737	**2200**	**22110**	0.737	**30000**
1768.8	0.737	**2400**	**23584**	0.737	**32000**
1916.2	0.737	**2600**	**25058**	0.737	**34000**
2063.6	0.737	**2800**	**26532**	0.737	**36000**
2211	0.737	**3000**	**28006**	0.737	**38000**
2358.4	0.737	**3200**	**29480**	0.737	**40000**
2653.2	0.737	**3600**	**32428**	0.737	**44000**
2948	0.737	**4000**	**35376**	0.737	**48000**
3242.8	0.737	**4400**	**38324**	0.737	**52000**
3537.6	0.737	**4800**	**41272**	0.737	**56000**
3832.4	0.737	**5200**	**44220**	0.737	**60000**

HYTORC®

PROBABLE DRIVE FAILURE

SQUARE/ALLEN DRIVE WORKING TORQUE

DRIVE SIZE: The square or hex drive of each HYTORC is limited in its maximum output by its material and its engagement area. Since your HYTORC uses specially suited alloy steel for its drive members, the following maximum torque output can be achieved without drive failure, provided the reaction member abuts close to the same plane as the nut to be turned.

DRIVE SIZE	MAXIMUM WORKING TORQUE	PROBABLE FAILURE
1/2" Allen	350 ft./lbs.	380 ft./lbs.
1/2" Square	385 ft./lbs.	425 ft./lbs.
5/8" Allen	685 ft.ll bs.	750 ft./lbs.
3/4" Allen	1,185 ft./lbs.	1,300 ft./lbs.
3/4" Square	1,390 ft./lbs.	1,485 ft./lbs.
7/8" Allen	1,880 ft./lbs.	2,065 ft./lbs.
1" Allen	2,810 ft./lbs.	3,100 ft./lbs.
1" Square	3,230 ft./lbs.	3,400 ft./lbs.
1-1/8" Allen	4,000 ft./lbs.	4,400 ft./lbs.
1-1/4" Allen	5,500 ft./lbs.	6,100 ft./lbs.
1-3/8" Allen	7,300 ft./lbs.	8,000 ft./lbs.
1-1/2" Allen	9,500 ft./lbs.	10,400 ft./lbs.
1-1/2" Square	11,520 ft./lbs.	12,475 ft./lbs.
1-5/8" Allen	12,000 ft.ll bs.	13,200 ft./lbs.
1-3/4" Allen	15,000 ft./lbs.	16,500 ft./lbs.
1-7/8" Allen	18,500 ft./lbs.	20,300 ft./lbs.
2" Allen	22,500 ft.l\bs.	24,700 ft./lbs.
2-1/4" Allen	32,000 ft.ll bs.	35,100 ft./lbs.
2-1/2" Allen	44,000 ft./lbs.	48,200 ft./lbs.
2-1/2" Square	52,500 ft./lbs.	63,625 ft./lbs.

If the reaction arm cannot abut on the same plane as the nut to be turned. Less torque should be applied as the additional side load has to be taken Into consideration.

When torque requirements are close or more than the values listed above, use HYTORC's Socket Hex - Drive with replaceable Hex Insert Bits.

HYTORC®

Wrenches in Metric Sizes

Size in Inches	Eqv. in Metric
1 1/4"	31 mm
1 7/16"	36 mm
1 1/2"	38 mm
1 5/8"	41 mm
1 11/16"	43 mm
1 13/16"	46 mm
1 7/8"	48 mm
2"	51 mm
2 1/16"	52 mm
2 3/16"	55 mm
2 1/4"	57 mm
2 3/8"	60 mm
2 7/16"	62 mm
2 9/16"	65 mm
2 5/8"	66 mm
2 3/4"	70 mm
2 13/16"	71 mm
2 15/16"	75 mm
3"	76 mm
3 1/8"	79 mm
3 3/8"	85 mm
3 1/2"	89 mm
3 3/4"	95 mm
3 7/8"	98 mm
4 1/8"	105 mm
4 1/4"	108 mm
4 1/2"	114 mm
4 5/8"	117 mm
4 7/8"	124 mm
5"	127 mm
5 1/4"	133 mm
5 3/8"	136 mm
5 3/4"	146 mm
6"	152 mm
6 1/8"	155 mm

HYTORC®

API Flange Data
Wellheads & BOP's

Bore Size	Working Pressure	Nut Size A.F.	Bolt Size Dia.	Torque (FT. LBS.)	Recommended Tool
4 1/16"	5000	2"	1/4"	600-1000	HY-2XLCT
4 1/16"	10000	1 13/16"	1 1/8"	400-600	HY-2XLCT
4 1/16"	15000	2 3/16"	1 3/8"	700-1200	HY-2XLCT
4 1/16"	20000	2 3/4"	1 3/4"	1460-2040	HY-4XLCT
7 1/16"	2000	1 5/8"	1"	300-500	HY-2XLCT
7 1/16"	3000	1 13/16"	1 1/8"	400-600	HY-2XLCT
7 1/16"	5000	2 3/16"	1 3/8"	700-1200	HY-2XLCT
7 1/16"	10000	2 3/8"	1 1/2"	920-1400	HY-4XLCT
7 1/16"	15000	2 3/8"	1 1/2"	920-1400	HY-4XLCT
7 1/16"	20000	3 1/8"	2"	2190-3850	HY-4XLCT
9"	2000	1 13/16"	1 1/8"	400-600	HY-2XLCT
9"	3000	2 3/16"	1 3/8"	700-1200	HY-2XLCT
9"	5000	2 9/16"	1 5/8"	1170-1700	HY-4XLCT
9"	10000	2 3/8"	1 1/2"	920-1400	HY-4XLCT
9"	15000	2 15/16"	1 7/8"	1800-3220	HY-4XLCT
11"	2000	2"	1 1/4"	600-1000	HY-2XLCT
11"	3000	2 3/16"	1 3/8"	700-1200	HY-4XLCT
11"	5000	2 15/16"	1 7/8"	1800-3220	HY-4XLCT
11"	10000	2 3/4"	1 3/4"	1460-2040	HY-4XLCT
11"	15000	3 1/8"	2"	2190-3850	HY-4XLCT
13 5/8"	2000	2"	1 1/4"	600-1000	HY-2XLCT
13 5/8"	3000	2 3/16"	1 3/8"	700-1200	HY-4XLCT
13 5/8"	5000	2 9/16"	1 5/8"	1170-1700	HY-4XLCT
13 5/8"	10000	2 15/16"	1 7/8"	1800-3220	HY-4XLCT
13 5/8"	15000	3 1/2"	2 1/4"	3120-4150	HY-8XLCT
16 3/4"	2000	2 3/8"	1 1/2"	920-1400	HY-4XLCT
16 3/4"	3000	2 9/16"	1 5/8"	1170-1700	HY-4XLCT
16 3/4"	5000	2 15/16"	1 7/8"	1800-3220	HY-4XLCT
16 3/4"	10000	2 15/16"	1 7/8"	1800-3220	HY-4XLCT
18 3/4"	5000	3 1/8"	2"	2190-3850	HY-8XLCT
18 3/4"	10000	3 1/2"	2 1/4"	3120-4150	HY-8XLCT
18 3/4"	15000	4 5/8"	3"	6680-11300	HY-14XLCT
20 3/4"	3000	3 1/8"	2"	2190-3850	HY-8XLCT
21 1/4"	2000	2 9/16"	1 5/8"	1170-1700	HY-4XLCT
21 1/4"	5000	3 1/8"	2"	2190-3850	HY-4XLCT
21 1/4"	7500	3 7/8"	2 1/2"	4290-5100	HY-8XLCT
21 1/4"	10000	3 7/8"	2 1/2"	4290-5100	HY-8XLCT
26 3/4"	2000	2 3/4"	1 3/4"	1460-2040	HY-4XLCT
26 3/4"	3000	3 1/8"	2"	2190-3850	HY-4XLCT

Notes: (1) Use smaller torque value when using moly disulfide lubricant.
(2) Use larger torque value when using API 5A lubricant.

Common Markings on Nuts and Bolts

When it comes to nuts and bolts, there are many markings that you may come across. Common markers include letters, numbers, dashes, slashes, dots, and many more. Many nuts and bolts follow SAE or Metric standards ensuring strength and reliability.

SAE vs. Metric Markings

SAE Bolt Head Markings

The Society of Automotive Engineers created a system of grades to identify valuable information about the fastener. The grades of a fastener can represent what material it is made out of, its hardness range, and its strength characteristics. SAE grades use the imperial measurement system. The imperial measurement system uses inches.

The SAE J429 standard has specific requirements for bolts, screws, studs, sems, and U-bolts up to 1-1/2" in diameter. Bolts meeting SAE J429 standards have radial lines engraved on the bolt head.

Grade 2, 5, and 8 are the most common grades of fasteners according to the Society of Automotive Engineers standard. The higher the grade is, the stronger the material that makes up the fastener. The grade also represents the tensile strength, yield strength, and proof load of a fastener.

SAE Grade 2

- Does not have any radial line markings
- Lowest SAE grade with the least strength
- Comprised of low or medium carbon steel

SAE Grade 5

- Have three radial lines engraved

- Medium level strength
- Comprised of medium quenched and tempered carbon steel

SAE Grade 8

- Have six radial lines engraved
- Highest SAE grade with the most strength
- Comprised of medium quenched and tempered carbon alloy steel

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Metric Bolt Head Markings

Metric classes are set by the ISO (International Standards Organization). Metric markings combine two numbers separated by a dot. The number markings are engraved on the top or side of the bolt head. Common metric classes are 5.8, 8.8, 10.9, and 12.9. The higher the numbers are, the stronger the material of the fastener is.

The number that appears before the decimal, when multiplied by 100, will provide the approximate minimum tensile strength of the bolt. The number after the decimal, when multiplied by 10, will provide the approximate yield strength percentage in relation to the minimum tensile strength.

304 Stainless Steel Bolt Head Markings

Metric bolts made of 304 stainless steel are marked on the bolt head with A2-70. The A2 represents 304 stainless steel and 70 represents the tensile strength. The tensile strength equals 700 MPA general-purpose stainless steel. The number after the A2 will vary depending on the tensile strength of the bolt. 304 stainless steel has decent corrosion resistance.

316 Stainless Steel Bolt Head Markings

Metric bolts made of 316 stainless steel are marked on the head of the bolt with A4-70. The A4 represents 316 stainless steel and the 70 represents the tensile strength. The tensile strength equals 700 MPA marine grade stainless steel. The number after the A4 will vary depending on the tensile strength of the bolt.

The 316 stainless steel grade has high resistance to corrosion. The 316 stainless steel bolt is commonly used near salt water and a variety of other exterior applications.

Tensile Strength

Before using any fastener, being aware of its tensile strength, proof load, and yield strength is crucial so the fastener doesn't break or lose its elasticity during use.

Tensile strength is the amount of stress or load that the fastener can withstand by a material before it stretches and breaks. The tensile strength is tested by applying mechanical loads to the fastener. This amount of pressure determines its resilience. Understanding tensile strength is incredibly important when choosing hardware so it is clear if it is strong enough for the application.

Proof Load

Proof load is the limit of the elastic range of a bolt. If a bolt is tensioned beyond its specified proof load, it can't be used as it experiences plastic deformation. If it is tensioned within its specified proof load and has kept its original size and shape, it can be reused. Once the proof load is exceeded, it starts to yield and lose ductility.

Yield Strength

Lastly, yield strength is the maximum amount of stress a fastener can withstand before its shape is sufficiently deformed. Any deformation caused by stress greater than the yield strength results in the hardware being nonrecoverable for use.

Bolt Head Markings Chart

<table>
<tr><th colspan="6">US Bolts</th></tr>
<tr><th rowspan="2">Head Marking</th><th rowspan="2">Grade and Material</th><th rowspan="2">Nominal Size Range (inches)</th><th colspan="3">Mechanical Properties</th></tr>
<tr><th>Proof Load (psi)</th><th>Min. Yield Strength (psi)</th><th>Min. Tensile Strength (psi)</th></tr>
<tr><td></td><td>307A
Low carbon steel</td><td>1/4" thru 4"</td><td>N/A</td><td>N/A</td><td>60,000</td></tr>
<tr><td rowspan="2">No Markings</td><td rowspan="2">GRADE 2
Low or medium carbon steel</td><td>1/4" thru 3/4"</td><td>55,000</td><td>57,000</td><td>74,000</td></tr>
<tr><td>Over 3/4" thru 1-1/2"</td><td>33,000</td><td>36,000</td><td>60,000</td></tr>
<tr><td rowspan="2">
3 Radial Lines</td><td rowspan="2">GRADE 5
Medium carbon steel, quenched and tempered</td><td>1/4" thru 1"</td><td>85,000</td><td>92,000</td><td>120,000</td></tr>
<tr><td>Over 1" thru 1-1/2"</td><td>74,000</td><td>81,000</td><td>105,000</td></tr>
<tr><td>
6 Radial Lines</td><td>GRADE 8
Medium carbon alloy steel, quenched and tempered</td><td>1/4" thru 1-1/2"</td><td>120,000</td><td>130,000</td><td>150,000</td></tr>
</table>

	**GRADE A325** Carbon or alloy steel with or without boron	1/2" thru 1-1/2"	85,000	92,000	120,000
Stainless Markings Vary	**18-8 & 316 STAINLESS** Steel alloy with chromium and nickel	All sizes thru 1"	N/A	20,000 Min. 65,000 Typical	65,000 Min. 100,000 – 150,000 Typical
	**651 SILICON BRONZE** An alloy of mostly copper and tin with a small amount of silicon	1/4" thru 3/4"	N/A	55,000	70,000
		7/8" thru 1-1/2"	N/A	40,000	55,000
	**ALUMINUM 2024** Aluminum alloy with copper, magnesium and manganese; solution heat treated and age hardened	All sizes	N/A	36,000	55,000

Metric Bolts

Head Marking	Class and Material	Nominal Size Range (mm)	Mechanical Properties		
			Proof Load (MPa)	Min. Yield Strength (MPa)	Min. Tensile Strength (MPa)
	**CLASS 8.8** Medium carbon steel, quenched and tempered	All sizes below 16mm	580	640	800
		16mm - 72mm	600	660	830
	**CLASS 10.9** Alloy steel, quenched and tempered	5mm - 100mm	830	940	1040
	**CLASS 12.9** Alloy steel, quenched and tempered	1.6mm - 100mm	970	1100	1220
Usually Stamped A-2 or A-4	**A-2 & A-4 STAINLESS** Steel alloy with chromium and nickel	All sizes thru 20mm	N/A	210 Min. 450 Typical	500 Min. 700 Typical

Tensile Strength: The maximum load in tension (pulling apart) which a material can withstand before breaking or fracturing.

Yield Strength: The maximum load at which a material exhibits a specific permanent deformation.

Proof Load: An axial tensile load which the product must withstand without evidence of any permanent set.

1MPa = 1N/mm^2 = 145 pounds/$inch^2$

HYTORC®

FASTENER IDENTIFICATION

SPECIFICATION ASTM A193/A193M

Marking/Grade	Product	Material/Specification
B5 Grade B5	Bolts, screws, studs	Ferritic Steel, 5% Chromium, A151 Type 501.
B6 Grade B6	Bolts, screws, studs	Ferritic Steel, 12% Chromium, AISI Type 410.
B7 Grade B7	Bolts, screws, studs	Ferritic Steel, Chromium-Molybdenum, AISI Type 4140, 4142, 4145, 4140H, 4142H and 4145H.
B16 Grade B16	Bolts, screws, studs	Ferritic Steel, Chromium-Molybdenum - Vanadium.
B8 Grade B8 Class 1	Bolts, screws, studs	Austenitic Steel, Unstabilized, 18% Chromium - 8% Nickel, AISI Type 304, Carbide Solution Treated.
B8C Grade B8C Class 1	Bolts, screws, studs	Austenitic Steel, Stabilized, 18% Chromium-8% Nickel, AISI Type 347, Carbide Solution Treated.
B8P Grade B8P Class 1	Bolts, screws, studs	Austenitic Steel, Unstabilized, 18% Chromium - 8% Nickel, AISI Type 305 with Restricted Carbon, Carbide Solution Treated.

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FASTENER IDENTIFICATION

SPECIFICATION ASTM A193/A193M

Marking/Grade	Product	Material/Specification
B8T Grade B8T Class 1	Bolts, screws, studs	Austenitic Steel, Stabilized, 18% Chromium-8% Nickel, AISI Type 321, Carbide Solution Treated.
B8 Grade B8 Class 2	Bolts, screws, studs	Austenitic Steel, Unstabilized, 18% Chromium - 8% Nickel, AISI Type 304, Carbide Solution Treated and Strain Hardened.
B8C Grade B8C Class 2	Bolts, screws, studs	Austenitic Steel, Stabilized, 18% Chromium - 8% Nickel, AISI Type 347 Carbide Solution Treated and Strain Hardened.
B8P Grade B8P Class 2	Bolts, screws, studs	Austenitic Steel, Unstabilized, 18% Chromium - 8% Nickel, AISI Type 305 with Restricted Carbon, Carbide Solution Treated and Strain Hardened.
B8T Grade B8T Class 2	Bolts, screws, studs	Austenitic Steel Stabilized, 18% Chromium - 8% Nickel, AISI Type 321 Carbide Solution Treated and Strain Hardened.

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Marking/Grade	Product	Material/Specification
L7 Grade L7	Bolts, screws, studs	Ferritic Steel, Chromium - Molybdenum, AISI Type 4140, 4142 or 4145, Quenched and Tempered.
L7A Grade L7A	Bolts, screws, studs	Ferritic Steel, Carbon - Molybdenum, AISI Type 4037, Quenched and Tempered.
L7B Grade L7B	Bolts, screws, studs	Ferritic Steel, Chromium - Molybdenum, AISI Type 4137, Quenched and Tempered.
L7C Type 3740, Grade L7C	Bolts, screws, studs	Ferritic Steel, Nickel - Chromium - Molybdenum, AISI Quenched and Tempered.
L43 Type 4340, Grade L43	Bolts, screws, studs	Ferritic Steel, Nickel - Chromium - Molybdenum, AISI Quenched and Tempered.
B8 Grade B8 Class 1	Bolts, screws, studs	Austenitic Steel, Unstabilized, 18% Chromium - 8% Nickel, AISI Type 304 Carbide Solution Treated.
B8C Grade B8C Class 1	Bolts, screws, studs	Austenitic Steel, Stabilized, 18% Chromium-8% Nickel, AISI Type 347, Carbide Solution Treated.
B8T Grade B8T Class 1	Bolts, screws, studs	Austenitic Steel, Stabilized, 18% Chromium-8% Nickel, AISI Type 321, Carbide Solution Treated.

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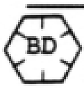
Marking/Grade	Product	Material/Specification
B8P Grade B8P Class 1	Bolts, screws, studs	Austenitic Steel, Unstabilized, 18% Chromiu - 8% Nickel, AISI Type 30 with Restricted Carbon, Carbide Solution Treated.
B8F Grade B8F Class 1	Bolts, screws, studs	Austenitic Steel with Added Sulfur, AISI Type 303, Carbide Solution Treated.
B8 Grade B8 Class 2	Bolts, screws, studs	Austenitic Steel, Unstabilized, 18% Chromiur - 8% Nickel, AISI Type 304, Carbide Solution Treated and Strain Hardened.
B8C Grade B8C Class 2	Bolts, screws, studs	Austenitic Steel, Stabilized, 18% Chromium - 8% Nickel, AISI Type 347 Carbide Solution Treated and Strain Hardened.
B8T Grade B8T Class 2	Bolts, screws, studs	Austenitic Steel, Stabilized, 18% Chromium - 8% Nickel, AISI Type 321, Carbide Solution Treated and Strain Hardened.
B8P Grade B8P Class 2	Bolts, screws, studs	Austenitic Steel, Unstabilized, 18% Chromiur - 8% Nickel, AISI Type 30 with Restricted Carbon, Carbide Solution Treated and Strain Hardened.
B8F Grade B8F Class 2	Bolts, screws, studs	Austenitic Steel with Added Sulfur, AISI Type 303, Carbon Solution Treated A Strain Hardened

SPECIFICATION ASTM A325

Marking/Grade	Product	Material/Specification
 Type 1	Bolts	Medium Carbon Steel, Quenched and Tempered.
 Type 2	Bolts	Low Carbon Martensite Steel, Quenched and Tempered.
 Type 3	Bolts	Atmospheric Corrosion Resisting Steel, Quenched and Tempered.

SPECIFICATION ASTM A354

Marking/Grade	Product	Material/Specification
 Grade BC	Bolts, studs	Alloy Steel, Quenched and Tempered.
 Grade BD	Bolts, studs	Alloy Steel, Quenched in Oil and Tempered.
 Type 1	Bolts, studs	Medium - Carbon Steel, Quenched and Tempered.

FASTENER IDENTIFICATION

SPECIFICATION ASTM A449

Marking/Grade	Product	Material/Specification
 Type 2	Bolts, studs	Low - Carbon Martensite o Medium - Carbon Martensit Fully Killed, Fine Grain Steel, Quenched and Tempered.

SPECIFICATION ASTM A490

Marking/Grade	Product	Material/Specification
 Type 1	Bolts	Alloy Steel, Quenched in Oil and Tempered.
 Type 2	Bolts	Low Carbon Martensite Steel, Quenched and Tempered.
 Type 3	Bolts	Atmospheric Corrosion Resistant Steel, Quenched and Tempered.

Marking/Grade	Product	Material/Specification
B21 Grade B21 Class 1 thru 5	Bolts, studs	Alloy Steel, Chromium - Molybdenum - Vanadium, Quenched and Tempered.
B22 Grade B22 Class 1 thru 5	Bolts, studs	Alloy Steel, Chromium - Molybdenum - AISI Type 4142-H, Quenched and Tempered.
B23 Type E-4340-H, Grade B23 Class 1 thru 5	Bolts, studs	Alloy Steel, Chromium - Nickel - Molybdenum, AISI Quenched and Tempered.
B24 Grade B24 Class 1 thru 5	Bolts, studs	Alloy Steel, Chromium - Nickel - Molybdenum, AISI Type 4240 Mod, Quenched and Tempered.
B24V Grade B24V Class 1 thru 3	Bolts, studs	Alloy Steel, Chromium - Nickel - Molybdenum - Vanadium, AISI Type 4340V Mod, Quenched and Tempered.

HYTORC AVANTI - .7

PRESSURE/TORQUE CONVERSION CHART

PRESSURE IN PSI	FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	103	14	140	104
1600	110	15	149	110
1800	125	17	169	124
2000	139	19	188	138
2200	154	21	209	152
2400	168	23	228	166
2600	183	25	248	179
2800	197	27	267	193
3000	212	29	287	207
3200	227	31	308	221
3400	242	33	328	235
3600	256	35	347	248
3800	271	37	367	262
4000	286	40	388	276
4200	301	42	408	290
4400	316	44	428	304
4600	331	46	449	317
4800	345	48	468	331
5000	360	50	488	345
5200	375	52	508	359
5400	391	54	530	373
5600	406	56	550	386
5800	421	58	571	400
6000	436	60	591	414
6200	451	62	611	428
6400	466	64	632	442
6600	481	67	652	455
6800	496	69	672	469
7000	511	71	693	483
7200	526	73	713	497
7400	542	75	735	511
7600	557	77	755	524
7800	573	79	777	538
8000	588	81	797	552
8200	604	84	819	566
8400	620	86	840	580
8600	635	88	861	593
8800	651	90	882	607
9000	667	92	904	621
9200	682	94	925	635
9400	697	96	945	649
9600	713	99	967	662
9800	728	101	987	676
10000	744	103	1009	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC AVANTI-1

PRESSURE/TORQUE CONVERSION CHART

PRESSURE IN PSI	FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	196	27	266	104
1600	209	29	283	110
1800	235	33	319	124
2000	261	36	354	138
2200	288	40	390	152
2400	315	44	427	166
2600	241	33	327	179
2800	368	51	499	193
3000	395	55	535	207
3200	421	58	571	221
3400	447	62	606	235
3600	473	65	641	248
3800	499	69	676	262
4000	525	73	712	276
4200	551	76	747	290
4400	577	80	782	304
4600	603	83	817	317
4800	629	87	853	331
5000	655	91	888	345
5200	680	94	922	359
5400	705	98	956	373
5600	730	101	990	386
5800	755	104	1023	400
6000	780	108	1057	414
6200	805	111	1091	428
6400	831	115	1127	442
6600	856	118	1160	455
6800	882	122	1196	469
7000	907	125	1230	483
7200	932	129	1263	497
7400	957	132	1297	511
7600	981	136	1330	524
7800	1006	139	1364	538
8000	1031	143	1398	552
8200	1056	146	1432	566
8400	1081	150	1465	580
8600	1107	153	1501	593
8800	1132	157	1535	607
9000	1157	160	1568	621
9200	1182	163	1602	635
9400	1208	167	1638	649
9600	1233	171	1671	662
9800	1259	174	1707	676
10000	1284	178	1741	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC AVANTI-3

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	428	59	580	104
1600	458	63	621	110
1800	517	72	701	124
2000	577	80	782	138
2200	636	88	862	152
2400	695	96	942	166
2600	754	104	1022	179
2800	813	112	1102	193
3000	872	121	1182	207
3200	931	129	1262	221
3400	990	137	1342	235
3600	1048	145	1421	248
3800	1107	153	1501	262
4000	1166	161	1581	276
4200	1225	169	1661	290
4400	1283	177	1739	304
4600	1342	186	1819	317
4800	1400	194	1898	331
5000	1459	202	1978	345
5200	1517	210	2056	359
5400	1574	218	2134	373
5600	1632	226	2212	386
5800	1589	220	2154	400
6000	1747	242	2368	414
6200	1803	249	2444	428
6400	1859	257	2520	442
6600	1916	265	2597	455
6800	1972	273	2673	469
7000	2028	280	2749	483
7200	2084	288	2825	497
7400	2140	296	2901	511
7600	2197	304	2978	524
7800	2253	312	3054	538
8000	2309	319	3130	552
8200	2365	327	3206	566
8400	2421	335	3282	580
8600	2478	343	3359	593
8800	2534	350	3435	607
9000	2590	358	3511	621
9200	2644	366	3584	635
9400	2698	373	3657	649
9600	2753	381	3732	662
9800	2807	388	3805	676
10000	2861	396	3878	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC AVANTI-5

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	766	106	1038	104
1600	820	113	1112	110
1800	927	128	1257	124
2000	1035	143	1403	138
2200	1139	158	1544	152
2400	1243	172	1685	166
2600	1347	186	1826	179
2800	1451	201	1967	193
3000	1555	215	2108	207
3200	1660	230	2250	221
3400	1765	244	2393	235
3600	1871	259	2536	248
3800	1976	273	2679	262
4000	2081	288	2821	276
4200	2185	302	2962	290
4400	2289	317	3103	304
4600	2392	331	3243	317
4800	2496	345	3384	331
5000	2600	360	3525	345
5200	2703	374	3664	359
5400	2806	388	3804	373
5600	2909	402	3943	386
5800	3012	417	4083	400
6000	3115	431	4223	414
6200	3215	445	4358	428
6400	3316	459	4495	442
6600	3416	472	4631	455
6800	3517	486	4768	469
7000	3617	500	4903	483
7200	3715	514	5036	497
7400	3814	527	5170	511
7600	3912	541	5303	524
7800	4011	555	5437	538
8000	4109	568	5570	552
8200	4208	582	5704	566
8400	4307	596	5839	580
8600	4407	609	5974	593
8800	4506	623	6108	607
9000	4605	637	6243	621
9200	4703	650	6375	635
9400	4801	664	6508	649
9600	4899	678	6641	662
9800	4997	691	6774	676
10000	5095	705	6907	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC AVANTI-8

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	1150	159	1559	104
1600	1230	170	1667	110
1800	1391	192	1886	124
2000	1552	215	2104	138
2200	1712	237	2321	152
2400	1872	259	2538	166
2600	2032	281	2755	179
2800	2192	303	2971	193
3000	2352	325	3188	207
3200	2512	347	3405	221
3400	2672	370	3622	235
3600	2831	392	3838	248
3800	2991	414	4055	262
4000	3151	436	4271	276
4200	3310	458	4487	290
4400	3469	480	4703	304
4600	3628	502	4918	317
4800	3787	524	5134	331
5000	3946	546	5349	345
5200	4103	567	5562	359
5400	4259	589	5774	373
5600	4416	611	5986	386
5800	4572	632	6198	400
6000	4729	654	6411	414
6200	4884	675	6621	428
6400	5039	697	6831	442
6600	5194	718	7041	455
6800	5349	740	7251	469
7000	5504	761	7461	483
7200	5656	782	7667	497
7400	5807	803	7872	511
7600	5959	824	8078	524
7800	6110	845	8283	538
8000	6262	866	8489	552
8200	6413	887	8693	566
8400	6563	908	8897	580
8600	6714	929	9101	593
8800	6864	949	9305	607
9000	7015	970	9510	621
9200	7164	991	9712	635
9400	7313	1011	9914	649
9600	7462	1032	10115	662
9800	7611	1053	10317	676
10000	7760	1073	10519	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC AVANTI-10

PRESSURE/TORQUE CONVERSION CHART

PRESSURE IN PSI	FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	1478	204	2004	104
1600	1578	218	2139	110
1800	1778	246	2410	124
2000	1978	274	2681	138
2200	2183	302	2959	152
2400	2389	330	3239	166
2600	2594	359	3516	179
2800	2800	387	3796	193
3000	3005	416	4074	207
3200	3210	444	4351	221
3400	3415	472	4629	235
3600	3621	501	4909	248
3800	3826	529	5187	262
4000	4031	557	5464	276
4200	4231	585	5736	290
4400	4431	613	6007	304
4600	4630	640	6276	317
4800	4830	668	6548	331
5000	5030	696	6819	345
5200	5233	724	7094	359
5400	5436	752	7369	373
5600	5640	780	7646	386
5800	5843	808	7921	400
6000	5046	698	6840	414
6200	6249	864	8471	428
6400	6452	892	8746	442
6600	6656	921	9023	455
6800	6859	949	9298	469
7000	7062	977	9573	483
7200	7262	1004	9844	497
7400	7462	1032	10115	511
7600	7661	1060	10385	524
7800	7861	1087	10656	538
8000	8061	1115	10927	552
8200	8262	1143	11200	566
8400	8464	1171	11474	580
8600	8665	1198	11746	593
8800	8867	1226	12020	607
9000	9068	1254	12293	621
9200	9269	1282	12565	635
9400	9471	1310	12839	649
9600	9672	1338	13111	662
9800	9874	1366	13385	676
10000	10075	1393	13658	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC AVANTI-10

PRESSURE/TORQUE CONVERSION CHART

FOR SERIAL NUMBER 3132C AND HIGHER

PRESSURE IN PSI	FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	1800	249	2440	104
1600	1920	266	2603	110
1800	2160	299	2928	124
2000	2400	332	3253	138
2200	2639	365	3577	152
2400	2878	398	3901	166
2600	2117	293	2870	179
2800	3356	464	4549	193
3000	3595	497	4873	207
3200	3834	530	5197	221
3400	4073	563	5521	235
3600	4312	596	5845	248
3800	4551	629	6169	262
4000	4790	662	6493	276
4200	5030	696	6819	290
4400	5270	729	7144	304
4600	5510	762	7469	317
4800	5750	795	7795	331
5000	5990	828	8120	345
5200	6230	862	8445	359
5400	6470	895	8771	373
5600	6710	928	9096	386
5800	6950	961	9421	400
6000	7190	994	9747	414
6200	7429	1027	10071	428
6400	7668	1060	10395	442
6600	7907	1094	10719	455
6800	8146	1127	11043	469
7000	8385	1160	11367	483
7200	8625	1193	11692	497
7400	8865	1226	12017	511
7600	9104	1259	12341	524
7800	9344	1292	12667	538
8000	9584	1325	12992	552
8200	9824	1359	13317	566
8400	10063	1392	13641	580
8600	10303	1425	13967	593
8800	10542	1458	14291	607
9000	10782	1491	14616	621
9200	10974	1518	14876	635
9400	11166	1544	15137	649
9600	11359	1571	15398	662
9800	11551	1598	15659	676
10000	11743	1624	15919	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC AVANTI-20

PRESSURE/TORQUE CONVERSION CHART

PRESSURE IN PSI	FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	2805	388	3802	104
1600	2999	415	4065	110
1800	3386	468	4590	124
2000	3773	522	5115	138
2200	4160	575	5639	152
2400	4548	629	6165	166
2600	4935	683	6690	179
2800	5323	736	7216	193
3000	5710	790	7740	207
3200	6105	844	8276	221
3400	6500	899	8811	235
3600	6895	954	9347	248
3800	7290	1008	9882	262
4000	7685	1063	10418	276
4200	8062	1115	10929	290
4400	8440	1167	11441	304
4600	8817	1219	11952	317
4800	9195	1272	12465	331
5000	9572	1324	12976	345
5200	9959	1377	13500	359
5400	10346	1431	14025	373
5600	10733	1484	14550	386
5800	11120	1538	15074	400
6000	11507	1591	15599	414
6200	11892	1645	16121	428
6400	12276	1698	16641	442
6600	12661	1751	17163	455
6800	13045	1804	17684	469
7000	13430	1857	18206	483
7200	13824	1912	18740	497
7400	14218	1966	19274	511
7600	14612	2021	19808	524
7800	16006	2214	21698	538
8000	15400	2130	20876	552
8200	15768	2181	21375	566
8400	16136	2232	21874	580
8600	16504	2283	22373	593
8800	16872	2333	22872	607
9000	17240	2384	23371	621
9200	17656	2442	23934	635
9400	18073	2499	24500	649
9600	18489	2557	25064	662
9800	18906	2615	25629	676
10000	19322	2672	26193	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC AVANTI-35

PRESSURE/TORQUE CONVERSION CHART

PRESSURE IN PSI	FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	4955	685	6717	104
1600	5285	731	7164	110
1800	5946	822	8060	124
2000	6607	914	8956	138
2200	7285	1008	9876	152
2400	7962	1101	10793	166
2600	8640	1195	11712	179
2800	9317	1289	12630	193
3000	9995	1382	13549	207
3200	10683	1477	14482	221
3400	11371	1573	15415	235
3600	12059	1668	16347	248
3800	12747	1763	17280	262
4000	13435	1858	18212	276
4200	14114	1952	19133	290
4400	14792	2046	20052	304
4600	15471	2140	20972	317
4800	16149	2233	21892	331
5000	16828	2327	22812	345
5200	17534	2425	23769	359
5400	18240	2523	24726	373
5600	18946	2620	25683	386
5800	19652	2718	26640	400
6000	20358	2816	27597	414
6200	21045	2911	28529	428
6400	21733	3006	29461	442
6600	22420	3101	30393	455
6800	23108	3196	31325	469
7000	23795	3291	32257	483
7200	24465	3384	33165	497
7400	25136	3476	34074	511
7600	25806	3569	34983	524
7800	26477	3662	35892	538
8000	27147	3754	36800	552
8200	27860	3853	37767	566
8400	28572	3952	38732	580
8600	29285	4050	39699	593
8800	29997	4149	40664	607
9000	30710	4247	41630	621
9200	31380	4340	42539	635
9400	32050	4433	43447	649
9600	32720	4525	44355	662
9800	33390	4618	45263	676
10000	34060	4710	46172	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC AVANTI-50

PRESSURE/TORQUE CONVERSION CHART

PRESSURE IN PSI	FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	7180	993	9733	104
1600	7667	1060	10393	110
1800	8641	1195	11714	124
2000	9615	1330	13034	138
2200	10622	1469	14399	152
2400	11629	1608	15764	166
2600	12636	1748	17129	179
2800	13643	1887	18494	193
3000	14650	2026	19860	207
3200	15593	2157	21138	221
3400	16536	2287	22416	235
3600	17479	2417	23695	248
3800	18422	2548	24973	262
4000	19365	2678	26251	276
4200	20272	2804	27481	290
4400	21179	2929	28710	304
4600	22086	3054	29940	317
4800	22993	3180	31169	331
5000	23900	3305	32399	345
5200	24753	3423	33555	359
5400	25606	3541	34711	373
5600	26459	3659	35868	386
5800	27312	3777	37024	400
6000	28165	3895	38180	414
6200	28988	4009	39296	428
6400	29811	4123	40412	442
6600	30634	4237	41527	455
6800	31457	4351	42643	469
7000	32280	4464	43759	483
7200	33033	4568	44780	497
7400	33786	4673	45800	511
7600	34539	4777	46821	524
7800	35292	4881	47842	538
8000	36045	4985	48863	552
8200	36651	5069	49684	566
8400	37257	5153	50506	580
8600	37863	5236	51327	593
8800	38469	5320	52149	607
9000	39075	5404	52970	621
9200	39744	5497	53877	635
9400	40413	5589	54784	649
9600	41082	5682	55691	662
9800	41751	5774	56598	676
10000	42420	5867	57505	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC AVANTI-80

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	11965	1655	16220	104
1600	12802	1771	17354	110
1800	14476	2002	19624	124
2000	16150	2234	21893	138
2200	17847	2468	24193	152
2400	19544	2703	26494	166
2600	21241	2938	28794	179
2800	22938	3172	31095	193
3000	24635	3407	33395	207
3200	26351	3644	35721	221
3400	28067	3882	38048	235
3600	29783	4119	40374	248
3800	31499	4356	42700	262
4000	32215	4455	43671	276
4200	34925	4830	47344	290
4400	36635	5067	49662	304
4600	38345	5303	51980	317
4800	40055	5540	54299	331
5000	41765	5776	56617	345
5200	43501	6016	58970	359
5400	45237	6256	61323	373
5600	46973	6496	63677	386
5800	48709	6736	66030	400
6000	50445	6977	68383	414
6200	52323	7236	70929	428
6400	54201	7496	73475	442
6600	56079	7756	76021	455
6800	57957	8015	78567	469
7000	59835	8275	81112	483
7200	61441	8497	83289	497
7400	63047	8719	85467	511
7600	64653	8942	87644	524
7800	66259	9164	89821	538
8000	67865	9386	91998	552
8200	69646	9632	94412	566
8400	71427	9878	96826	580
8600	73208	10125	99241	593
8800	74989	10371	101655	607
9000	76770	10617	104069	621
9200	78555	10864	106489	635
9400	80340	11111	108909	649
9600	82125	11358	111329	662
9800	83910	11605	113748	676
10000	85695	11852	116168	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC AVANTI-130

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	19395	2682	26292	104
1600	20742	2869	28118	110
1800	23436	3241	31770	124
2000	26130	3614	35422	138
2200	28840	3989	39096	152
2400	31550	4363	42769	166
2600	34260	4738	46443	179
2800	36970	5113	50117	193
3000	39680	5488	53790	207
3200	42402	5864	57480	221
3400	45124	6241	61170	235
3600	47846	6617	64860	248
3800	50568	6994	68550	262
4000	53290	7370	72240	276
4200	56128	7763	76087	290
4400	58966	8155	79934	304
4600	61804	8547	83782	317
4800	64642	8940	87629	331
5000	67480	9332	91476	345
5200	70216	9711	95185	359
5400	72952	10089	98894	373
5600	75688	10468	102603	386
5800	78424	10846	106312	400
6000	81160	11224	110020	414
6200	84236	11650	114190	428
6400	87312	12075	118360	442
6600	90388	12501	122530	455
6800	93464	12926	126700	469
7000	96540	13351	130870	483
7200	99394	13746	134739	497
7400	102247	14141	138606	511
7600	105101	14535	142475	524
7800	107954	14930	146342	538
8000	110808	15325	150211	552
8200	113578	15708	153966	566
8400	116348	16091	157721	580
8600	119119	16474	161478	593
8800	121889	16857	165233	607
9000	124659	17240	168988	621
9200	127429	17623	172743	635
9400	130199	18007	176498	649
9600	132970	18390	180254	662
9800	135740	18773	184009	676
10000	138510	19156	187764	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC AVANTI-1 REAR ARM

PRESSURE/TORQUE CONVERSION CHART

PRESSURE IN PSI	FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	200	28	271	104
1600	214	30	290	110
1800	242	33	328	124
2000	270	37	366	138
2200	297	41	403	152
2400	324	45	439	166
2600	351	49	476	179
2800	378	52	512	193
3000	405	56	549	207
3200	431	60	584	221
3400	457	63	620	235
3600	483	67	655	248
3800	509	70	690	262
4000	535	74	725	276
4200	562	78	762	290
4400	589	81	798	304
4600	616	85	835	317
4800	643	89	872	331
5000	670	93	908	345
5200	697	96	945	359
5400	724	100	981	373
5600	751	104	1018	386
5800	778	108	1055	400
6000	805	111	1091	414
6200	832	115	1128	428
6400	859	119	1164	442
6600	886	123	1201	455
6800	913	126	1238	469
7000	940	130	1274	483
7200	967	134	1311	497
7400	994	137	1347	511
7600	1021	141	1384	524
7800	1048	145	1421	538
8000	1075	149	1457	552
8200	1101	152	1493	566
8400	1127	156	1528	580
8600	1153	159	1563	593
8800	1179	163	1598	607
9000	1205	167	1633	621
9200	1232	170	1670	635
9400	1259	174	1707	649
9600	1286	178	1743	662
9800	1313	182	1780	676
10000	1340	185	1817	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC AVANTI-3 REAR ARM

PRESSURE/TORQUE CONVERSION CHART

PRESSURE IN PSI	FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	457	63	620	104
1600	488	67	662	110
1800	551	76	747	124
2000	613	85	831	138
2200	675	93	915	152
2400	736	102	998	166
2600	798	110	1082	179
2800	859	119	1164	193
3000	921	127	1249	207
3200	984	136	1334	221
3400	1046	145	1418	235
3600	1109	153	1503	248
3800	1171	162	1587	262
4000	1234	171	1673	276
4200	1296	179	1757	290
4400	1358	188	1841	304
4600	1420	196	1925	317
4800	1482	205	2009	331
5000	1544	214	2093	345
5200	1606	222	2177	359
5400	1668	231	2261	373
5600	1731	239	2347	386
5800	1793	248	2431	400
6000	1855	257	2515	414
6200	1918	265	2600	428
6400	1981	274	2685	442
6600	2043	283	2769	455
6800	2106	291	2855	469
7000	2169	300	2940	483
7200	2233	309	3027	497
7400	2296	318	3112	511
7600	2360	326	3199	524
7800	2423	335	3285	538
8000	2487	344	3371	552
8200	2549	353	3455	566
8400	2611	361	3539	580
8600	2672	370	3622	593
8800	2734	378	3706	607
9000	2796	387	3790	621
9200	2857	395	3873	635
9400	2918	404	3956	649
9600	2978	412	4037	662
9800	3039	420	4120	676
10000	3100	429	4202	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC AVANTI-5 REAR ARM

PRESSURE/TORQUE CONVERSION CHART

PRESSURE IN PSI	FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	802	111	1087	104
1600	857	119	1162	110
1800	967	134	1311	124
2000	1077	149	1460	138
2200	1185	164	1606	152
2400	1293	179	1753	166
2600	1402	194	1901	179
2800	1510	209	2047	193
3000	1618	224	2193	207
3200	1728	239	2342	221
3400	1838	254	2492	235
3600	1948	269	2641	248
3800	2058	285	2790	262
4000	2168	300	2939	276
4200	2279	315	3089	290
4400	2390	331	3240	304
4600	2502	346	3392	317
4800	2613	361	3542	331
5000	2724	377	3693	345
5200	2835	392	3843	359
5400	2946	407	3994	373
5600	3056	423	4143	386
5800	3167	438	4293	400
6000	3278	453	4444	414
6200	3388	469	4593	428
6400	3499	484	4743	442
6600	3609	499	4892	455
6800	3420	473	4636	469
7000	3930	544	5328	483
7200	3939	545	5340	497
7400	4048	560	5487	511
7600	4158	575	5637	524
7800	4267	590	5784	538
8000	4376	605	5932	552
8200	4485	620	6080	566
8400	4594	635	6228	580
8600	4703	650	6375	593
8800	4912	679	6659	607
9000	4921	681	6671	621
9200	5029	696	6817	635
9400	5136	710	6962	649
9600	5244	725	7109	662
9800	5351	740	7254	676
10000	5459	755	7400	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC AVANTI-10 REAR ARM

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	1840	254	2494	104
1600	1964	272	2662	110
1800	2213	306	3000	124
2000	2462	340	3337	138
2200	2709	375	3672	152
2400	2956	409	4007	166
2600	3204	443	4343	179
2800	2451	339	3323	193
3000	3698	511	5013	207
3200	3945	546	5348	221
3400	4192	580	5683	235
3600	4440	614	6019	248
3800	4687	648	6354	262
4000	4934	682	6689	276
4200	5184	717	7027	290
4400	5433	751	7365	304
4600	5683	786	7704	317
4800	5932	820	8041	331
5000	6182	855	8380	345
5200	6430	889	8717	359
5400	6678	924	9053	373
5600	6927	958	9390	386
5800	7175	992	9726	400
6000	7423	1027	10063	414
6200	7674	1061	10403	428
6400	7925	1096	10743	442
6600	8177	1131	11085	455
6800	8428	1166	11425	469
7000	8679	1200	11765	483
7200	8840	1223	11984	497
7400	9001	1245	12202	511
7600	9162	1267	12420	524
7800	9324	1290	12640	538
8000	9485	1312	12858	552
8200	9827	1359	13321	566
8400	10170	1407	13786	580
8600	10512	1454	14250	593
8800	10855	1501	14715	607
9000	11197	1549	15179	621
9200	11449	1583	15520	635
9400	11701	1618	15862	649
9600	11952	1653	16202	662
9800	12204	1688	16544	676
10000	12456	1723	16885	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC EDGE-P5

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	121	17	164	104
1600	129	18	175	110
1800	145	20	197	124
2000	162	22	220	138
2200	179	25	243	152
2400	196	27	266	166
2600	212	29	287	179
2800	229	32	311	193
3000	246	34	334	207
3200	263	36	357	221
3400	280	39	380	235
3600	297	41	403	248
3800	314	43	426	262
4000	331	46	449	276
4200	348	48	472	290
4400	365	50	495	304
4600	382	53	518	317
4800	398	55	540	331
5000	415	57	563	345
5200	432	60	586	359
5400	449	62	609	373
5600	466	64	632	386
5800	483	67	655	400
6000	500	69	678	414
6200	518	72	702	428
6400	535	74	725	442
6600	552	76	749	455
6800	569	79	772	469
7000	586	81	795	483
7200	603	83	818	497
7400	620	86	841	511
7600	637	88	864	524
7800	654	90	887	538
8000	572	79	776	552
8200	689	95	934	566
8400	706	98	957	580
8600	723	100	980	593
8800	740	102	1003	607
9000	757	105	1026	621
9200	774	107	1050	635
9400	790	109	1071	649
9600	806	111	1093	662
9800	823	114	1116	676
10000	839	116	1138	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC EDGE-1S & 2

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	178	25	241	104
1600	190	26	258	110
1800	215	30	292	124
2000	240	33	325	138
2200	265	37	359	152
2400	290	40	393	166
2600	315	44	427	179
2800	340	47	461	193
3000	365	50	495	207
3200	390	54	529	221
3400	416	58	564	235
3600	441	61	598	248
3800	467	65	633	262
4000	492	68	667	276
4200	517	72	701	290
4400	543	75	736	304
4600	568	79	770	317
4800	594	82	805	331
5000	619	86	839	345
5200	645	89	875	359
5400	670	93	909	373
5600	696	96	944	386
5800	721	100	978	400
6000	747	103	1013	414
6200	772	107	1047	428
6400	797	110	1081	442
6600	823	114	1116	455
6800	848	117	1150	469
7000	873	121	1184	483
7200	899	124	1219	497
7400	925	128	1254	511
7600	950	131	1288	524
7800	976	135	1323	538
8000	1002	139	1359	552
8200	1027	142	1393	566
8400	1053	146	1428	580
8600	1078	149	1462	593
8800	1104	153	1497	607
9000	1129	156	1531	621
9200	1155	160	1566	635
9400	1180	163	1600	649
9600	1206	167	1635	662
9800	1231	170	1669	676
10000	1257	174	1704	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC EDGE-3S & 4

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	443	61	601	104
1600	474	66	643	110
1800	535	74	725	124
2000	596	82	808	138
2200	658	91	892	152
2400	720	100	976	166
2600	782	108	1060	179
2800	844	117	1144	193
3000	906	125	1229	207
3200	969	134	1314	221
3400	1032	143	1399	235
3600	1094	151	1483	248
3800	1157	160	1569	262
4000	1220	169	1654	276
4200	1283	177	1740	290
4400	1347	186	1827	304
4600	1410	195	1912	317
4800	1474	204	1999	331
5000	1537	213	2084	345
5200	1599	221	2168	359
5400	1662	230	2254	373
5600	1724	238	2338	386
5800	1787	247	2423	400
6000	1849	256	2507	414
6200	1911	264	2591	428
6400	1974	273	2677	442
6600	2036	282	2761	455
6800	2099	290	2846	469
7000	2161	299	2930	483
7200	2223	307	3014	497
7400	2285	316	3098	511
7600	2346	324	3181	524
7800	2408	333	3265	538
8000	2470	342	3349	552
8200	2531	350	3432	566
8400	2593	359	3516	580
8600	2654	367	3599	593
8800	2716	376	3683	607
9000	2777	384	3766	621
9200	2837	392	3847	635
9400	2898	401	3930	649
9600	2958	409	4011	662
9800	3019	418	4094	676
10000	3079	426	4175	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC EDGE-6S AND 6

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	893	124	1211	104
1600	955	132	1295	110
1800	1079	149	1463	124
2000	1203	166	1631	138
2200	1328	184	1801	152
2400	1453	201	1970	166
2600	1579	218	2141	179
2800	1704	236	2311	193
3000	1830	253	2481	207
3200	1956	271	2652	221
3400	2083	288	2825	235
3600	2209	306	2995	248
3800	2335	323	3166	262
4000	2462	340	3338	276
4200	2589	358	3511	290
4400	2716	376	3683	304
4600	2843	393	3855	317
4800	2970	411	4027	331
5000	3097	428	4200	345
5200	3223	446	4370	359
5400	3350	463	4543	373
5600	3476	481	4713	386
5800	3603	498	4886	400
6000	3730	516	5058	414
6200	3859	534	5233	428
6400	3988	552	5408	442
6600	4117	569	5583	455
6800	4246	587	5758	469
7000	4375	605	5933	483
7200	4502	623	6105	497
7400	4629	640	6277	511
7600	4756	658	6449	524
7800	4883	675	6621	538
8000	5009	693	6792	552
8200	5136	710	6964	566
8400	5264	728	7138	580
8600	5391	746	7310	593
8800	5518	763	7482	607
9000	6545	905	8875	621
9200	5764	797	7816	635
9400	5883	814	7977	649
9600	6003	830	8140	662
9800	6122	847	8301	676
10000	6241	863	8463	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC EDGE-8 AND 9S

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	1230	170	1667	104
1600	1314	182	1781	110
1800	1482	205	2009	124
2000	1650	228	2237	138
2200	1821	252	2469	152
2400	1992	275	2700	166
2600	2163	299	2932	179
2800	2334	323	3164	193
3000	2505	346	3396	207
3200	2675	370	3626	221
3400	2845	393	3857	235
3600	3015	417	4087	248
3800	3185	440	4318	262
4000	3355	464	4548	276
4200	3526	488	4780	290
4400	3697	511	5012	304
4600	3868	535	5243	317
4800	4039	559	5475	331
5000	4210	582	5707	345
5200	4383	606	5942	359
5400	4556	630	6176	373
5600	4729	654	6411	386
5800	4902	678	6645	400
6000	5075	702	6880	414
6200	5249	726	7116	428
6400	5423	750	7351	442
6600	5597	774	7587	455
6800	5771	798	7823	469
7000	5945	822	8059	483
7200	6117	846	8292	497
7400	6289	870	8525	511
7600	6461	894	8759	524
7800	6633	917	8992	538
8000	6805	941	9225	552
8200	6979	965	9461	566
8400	7153	989	9697	580
8600	7327	1013	9932	593
8800	7501	1037	10168	607
9000	7675	1061	10404	621
9200	7851	1086	10643	635
9400	8027	1110	10881	649
9600	8203	1134	11120	662
9800	8379	1159	11359	676
10000	8555	1183	11597	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC EDGE-11S AND 12

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	1615	223	2189	104
1600	1726	239	2340	110
1800	1948	269	2641	124
2000	2171	300	2943	138
2200	2390	331	3240	152
2400	2610	361	3538	166
2600	2829	391	3835	179
2800	3049	422	4133	193
3000	3269	452	4431	207
3200	3494	483	4736	221
3400	3719	514	5041	235
3600	3944	545	5346	248
3800	4169	577	5651	262
4000	4395	608	5958	276
4200	4621	639	6264	290
4400	4847	670	6571	304
4600	5074	702	6878	317
4800	5300	733	7185	331
5000	5526	764	7491	345
5200	5759	796	7807	359
5400	5991	829	8121	373
5600	6223	861	8436	386
5800	6456	893	8752	400
6000	6688	925	9066	414
6200	6917	957	9377	428
6400	7145	988	9686	442
6600	7374	1020	9996	455
6800	7603	1051	10307	469
7000	7831	1083	10616	483
7200	8056	1114	10921	497
7400	8280	1145	11224	511
7600	8505	1176	11529	524
7800	8729	1207	11833	538
8000	8954	1238	12138	552
8200	9201	1272	12473	566
8400	9447	1307	12806	580
8600	9694	1341	13141	593
8800	9940	1375	13475	607
9000	10187	1409	13809	621
9200	10408	1439	14109	635
9400	10629	1470	14409	649
9600	10849	1500	14707	662
9800	11070	1531	15006	676
10000	11291	1562	15306	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC EDGE-30S AND 30

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	4448	615	6030	104
1600	4744	656	6431	110
1800	5337	738	7235	124
2000	5930	820	8039	138
2200	6523	902	8843	152
2400	7116	984	9646	166
2600	7709	1066	10450	179
2800	8302	1148	11254	193
3000	8895	1230	12058	207
3200	9488	1312	12862	221
3400	10081	1394	13666	235
3600	10674	1476	14470	248
3800	11267	1558	15274	262
4000	11860	1640	16077	276
4200	12453	1722	16881	290
4400	13046	1804	17685	304
4600	13639	1886	18489	317
4800	14232	1968	19293	331
5000	14825	2050	20097	345
5200	15418	2132	20901	359
5400	16011	2214	21705	373
5600	16604	2296	22508	386
5800	17197	2378	23312	400
6000	17790	2460	24116	414
6200	18383	2542	24920	428
6400	18976	2624	25724	442
6600	19569	2706	26528	455
6800	20132	2784	27291	469
7000	20755	2870	28135	483
7200	21348	2952	28939	497
7400	21941	3034	29743	511
7600	22534	3116	30547	524
7800	23127	3198	31351	538
8000	23720	3280	32155	552
8200	24313	3362	32959	566
8400	24906	3444	33763	580
8600	25499	3527	34566	593
8800	26093	3609	35372	607
9000	26685	3691	36174	621
9200	27287	3774	36990	635
9400	27871	3855	37782	649
9600	28464	3937	38586	662
9800	29257	4046	39661	676
10000	29650	4101	40194	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC ICE-P7

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	117	16	159	104
1600	125	17	170	110
1800	141	20	191	124
2000	158	22	214	138
2200	174	24	236	152
2400	190	26	258	166
2600	206	28	279	179
2800	222	31	301	193
3000	238	33	323	207
3200	254	35	344	221
3400	270	37	366	235
3600	286	40	388	248
3800	302	42	410	262
4000	318	44	431	276
4200	334	46	453	290
4400	351	49	476	304
4600	367	51	498	317
4800	383	53	519	331
5000	399	55	541	345
5200	415	57	563	359
5400	431	60	584	373
5600	447	62	606	386
5800	463	64	628	400
6000	480	66	651	414
6200	496	69	673	428
6400	512	71	694	442
6600	529	73	717	455
6800	545	75	739	469
7000	561	78	761	483
7200	578	80	784	497
7400	594	82	805	511
7600	610	84	827	524
7800	627	87	850	538
8000	643	89	872	552
8200	659	91	894	566
8400	676	93	917	580
8600	692	96	938	593
8800	708	98	960	607
9000	725	100	983	621
9200	741	102	1005	635
9400	757	105	1026	649
9600	773	107	1048	662
9800	790	109	1071	676
10000	806	111	1093	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC ICE-1

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	196	27	266	104
1600	209	29	283	110
1800	235	33	319	124
2000	261	36	354	138
2200	288	40	391	152
2400	315	44	427	166
2600	341	47	462	179
2800	268	37	363	193
3000	395	55	536	207
3200	421	58	571	221
3400	447	62	606	235
3600	476	66	645	248
3800	499	69	677	262
4000	525	73	712	276
4200	551	76	747	290
4400	577	80	782	304
4600	603	83	818	317
4800	629	87	853	331
5000	655	91	888	345
5200	680	94	922	359
5400	705	98	956	373
5600	730	101	990	386
5800	755	104	1024	400
6000	780	108	1058	414
6200	805	111	1092	428
6400	831	115	1127	442
6600	856	118	1161	455
6800	882	122	1196	469
7000	907	125	1230	483
7200	932	129	1264	497
7400	957	132	1298	511
7600	981	136	1330	524
7800	1006	139	1364	538
8000	1031	143	1398	552
8200	1056	146	1432	566
8400	1094	151	1483	580
8600	1107	153	1501	593
8800	1132	157	1535	607
9000	1157	160	1569	621
9200	1182	163	1603	635
9400	1208	167	1638	649
9600	1233	171	1672	662
9800	1259	174	1707	676
10000	1284	178	1741	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC ICE-3

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	445	62	603	104
1600	475	66	644	110
1800	536	74	727	124
2000	597	83	810	138
2200	658	91	892	152
2400	720	100	976	166
2600	781	108	1059	179
2800	843	117	1143	193
3000	904	125	1226	207
3200	965	133	1309	221
3400	1056	146	1432	235
3600	1088	150	1475	248
3800	1149	159	1558	262
4000	1210	167	1641	276
4200	1270	176	1722	290
4400	1330	184	1803	304
4600	1391	192	1886	317
4800	1451	201	1968	331
5000	1511	209	2049	345
5200	1571	217	2130	359
5400	1631	226	2212	373
5600	1691	234	2293	386
5800	1751	242	2374	400
6000	1811	250	2456	414
6200	1869	258	2534	428
6400	1928	267	2614	442
6600	1986	275	2693	455
6800	2045	283	2773	469
7000	2103	291	2852	483
7200	2161	299	2930	497
7400	2219	307	3009	511
7600	2277	315	3088	524
7800	2335	323	3166	538
8000	2393	331	3245	552
8200	2451	339	3324	566
8400	2508	347	3401	580
8600	2566	355	3479	593
8800	2623	363	3557	607
9000	2681	371	3635	621
9200	2739	379	3714	635
9400	2796	387	3791	649
9600	2854	395	3870	662
9800	2911	403	3947	676
10000	2969	411	4026	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC ICE-5

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	804	111	1090	104
1600	858	119	1163	110
1800	965	133	1309	124
2000	1072	148	1454	138
2200	1179	163	1599	152
2400	1286	178	1744	166
2600	1394	193	1890	179
2800	1501	208	2035	193
3000	1608	222	2180	207
3200	1715	237	2326	221
3400	1822	252	2471	235
3600	1930	267	2617	248
3800	2037	282	2762	262
4000	2144	297	2907	276
4200	2251	311	3052	290
4400	2358	326	3197	304
4600	2466	341	3344	317
4800	2573	356	3489	331
5000	2680	371	3634	345
5200	2787	385	3779	359
5400	2894	400	3924	373
5600	3002	415	4071	386
5800	3109	430	4216	400
6000	3216	445	4361	414
6200	3323	460	4506	428
6400	3430	474	4651	442
6600	3538	489	4798	455
6800	3645	504	4943	469
7000	3752	519	5088	483
7200	3859	534	5233	497
7400	3966	548	5378	511
7600	4074	563	5524	524
7800	4181	578	5669	538
8000	4288	593	5815	552
8200	4395	608	5960	566
8400	4502	623	6105	580
8600	4610	638	6251	593
8800	4717	652	6396	607
9000	4824	667	6541	621
9200	4931	682	6686	635
9400	5038	697	6832	649
9600	5146	712	6978	662
9800	5253	726	7123	676
10000	5360	741	7268	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC HY-.7MXT

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	118	16	160	104
1600	126	17	171	110
1800	143	20	194	124
2000	160	22	217	138
2200	176	24	239	152
2400	193	27	262	166
2600	209	29	283	179
2800	226	31	306	193
3000	242	33	328	207
3200	259	36	351	221
3400	275	38	373	235
3600	292	40	396	248
3800	308	43	418	262
4000	325	45	441	276
4200	342	47	464	290
4400	359	50	487	304
4600	375	52	508	317
4800	392	54	531	331
5000	409	57	554	345
5200	425	59	576	359
5400	442	61	599	373
5600	458	63	621	386
5800	475	66	644	400
6000	491	68	666	414
6200	508	70	689	428
6400	524	72	710	442
6600	541	75	733	455
6800	557	77	755	469
7000	574	79	778	483
7200	591	82	801	497
7400	608	84	824	511
7600	625	86	847	524
7800	642	89	870	538
8000	659	91	893	552
8200	675	93	915	566
8400	691	96	937	580
8600	706	98	957	593
8800	722	100	979	607
9000	738	102	1000	621
9200	755	104	1023	635
9400	772	107	1047	649
9600	788	109	1068	662
9800	805	111	1091	676
10000	822	114	1114	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC MXT-1

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	200	28	271	104
1600	214	30	290	110
1800	242	33	328	124
2000	270	37	366	138
2200	297	41	403	152
2400	324	45	439	166
2600	351	49	476	179
2800	378	52	512	193
3000	405	56	549	207
3200	431	60	584	221
3400	457	63	620	235
3600	483	67	655	248
3800	509	70	690	262
4000	535	74	725	276
4200	562	78	762	290
4400	589	81	798	304
4600	616	85	835	317
4800	643	89	872	331
5000	670	93	908	345
5200	697	96	945	359
5400	724	100	981	373
5600	751	104	1018	386
5800	778	108	1055	400
6000	805	111	1091	414
6200	832	115	1128	428
6400	859	119	1164	442
6600	886	123	1201	455
6800	913	126	1238	469
7000	840	116	1139	483
7200	967	134	1311	497
7400	994	137	1347	511
7600	1021	141	1384	524
7800	1048	145	1421	538
8000	1074	149	1456	552
8200	1101	152	1493	566
8400	1127	156	1528	580
8600	1153	159	1563	593
8800	1179	163	1598	607
9000	1205	167	1633	621
9200	1232	170	1670	635
9400	1259	174	1707	649
9600	1286	178	1743	662
9800	1313	182	1780	676
10000	1340	185	1817	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC MXT-3

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	480	66	651	104
1600	512	71	694	110
1800	576	80	781	124
2000	640	89	868	138
2200	704	97	954	152
2400	768	106	1041	166
2600	832	115	1128	179
2800	896	124	1215	193
3000	960	133	1301	207
3200	1024	142	1388	221
3400	1088	150	1475	235
3600	1152	159	1562	248
3800	1216	168	1648	262
4000	1280	177	1735	276
4200	1346	186	1825	290
4400	1412	195	1914	304
4600	1478	204	2004	317
4800	1544	214	2093	331
5000	1610	223	2183	345
5200	1674	232	2269	359
5400	1738	240	2356	373
5600	1802	249	2443	386
5800	1866	258	2530	400
6000	1930	267	2616	414
6200	1994	276	2703	428
6400	2058	285	2790	442
6600	2122	293	2877	455
6800	2186	302	2963	469
7000	2250	311	3050	483
7200	2316	320	3140	497
7400	2382	329	3229	511
7600	2448	339	3319	524
7800	2514	348	3408	538
8000	2580	357	3497	552
8200	2646	366	3587	566
8400	2712	375	3676	580
8600	2778	384	3766	593
8800	2844	393	3855	607
9000	2910	402	3945	621
9200	2974	411	4032	635
9400	3038	420	4118	649
9600	3102	429	4205	662
9800	3166	438	4292	676
10000	3230	447	4379	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC MXT-5

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	835	115	1132	104
1600	890	123	1206	110
1800	1000	138	1356	124
2000	1110	154	1505	138
2200	1222	169	1657	152
2400	1334	184	1808	166
2600	1446	200	1960	179
2800	1558	215	2112	193
3000	1670	231	2264	207
3200	1782	246	2416	221
3400	1894	262	2568	235
3600	2006	277	2719	248
3800	2118	293	2871	262
4000	2230	308	3023	276
4200	2342	324	3175	290
4400	2454	339	3327	304
4600	2566	355	3478	317
4800	2678	370	3630	331
5000	2790	386	3782	345
5200	2902	401	3934	359
5400	3014	417	4086	373
5600	3126	432	4238	386
5800	3238	448	4389	400
6000	3350	463	4541	414
6200	3462	479	4693	428
6400	3574	494	4845	442
6600	3686	510	4997	455
6800	3798	525	5149	469
7000	3910	541	5300	483
7200	4022	556	5452	497
7400	4134	572	5604	511
7600	4246	587	5756	524
7800	4358	603	5908	538
8000	4470	618	6060	552
8200	4582	634	6211	566
8400	4694	649	6363	580
8600	4806	665	6515	593
8800	4918	680	6667	607
9000	5030	696	6819	621
9200	5142	711	6970	635
9400	5254	727	7122	649
9600	5366	742	7274	662
9800	5478	758	7426	676
10000	5590	773	7578	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC MXT-10

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	1755	243	2379	104
1600	1864	258	2527	110
1800	2082	288	2822	124
2000	2300	318	3118	138
2200	2526	349	3424	152
2400	2752	381	3731	166
2600	2978	412	4037	179
2800	3204	443	4343	193
3000	3430	474	4650	207
3200	3656	506	4956	221
3400	3882	537	5262	235
3600	4108	568	5569	248
3800	4334	599	5875	262
4000	4560	631	6182	276
4200	4792	663	6496	290
4400	5024	695	6811	304
4600	5256	727	7125	317
4800	5488	759	7440	331
5000	5720	791	7754	345
5200	5948	823	8063	359
5400	6176	854	8372	373
5600	6404	886	8681	386
5800	6632	917	8990	400
6000	6860	949	9299	414
6200	7094	981	9617	428
6400	7328	1013	9934	442
6600	7562	1046	10251	455
6800	7796	1078	10568	469
7000	8030	1111	10885	483
7200	8264	1143	11203	497
7400	8498	1175	11520	511
7600	8732	1208	11837	524
7800	8966	1240	12154	538
8000	9200	1272	12472	552
8200	9432	1304	12786	566
8400	9664	1337	13101	580
8600	9896	1369	13415	593
8800	10128	1401	13730	607
9000	10360	1433	14044	621
9200	10592	1465	14359	635
9400	10824	1497	14673	649
9600	11056	1529	14988	662
9800	11288	1561	15302	676
10000	11520	1593	15617	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC MXT-15

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	2268	314	3075	104
1600	2423	335	3285	110
1800	2733	378	3704	124
2000	3042	421	4124	138
2200	3351	463	4542	152
2400	3659	506	4960	165
2600	3967	549	5378	179
2800	4276	591	5796	193
3000	4584	634	6214	207
3200	4892	677	6632	220
3400	5201	719	7050	234
3600	5509	762	7468	248
3800	5817	805	7886	262
4000	6126	847	8304	276
4200	6437	890	8726	290
4400	6749	933	9149	303
4600	7060	976	9571	317
4800	7372	1020	9993	331
5000	7683	1063	10415	345
5200	7995	1106	10838	358
5400	8307	1149	11262	372
5600	8620	1192	11685	386
5800	8932	1235	12108	400
6000	9244	1278	12531	414
6200	9557	1322	12955	427
6400	9869	1365	13379	441
6600	10182	1408	13803	455
6800	10495	1451	14227	468
7000	10808	1495	14651	482
7200	11114	1537	15066	496
7400	11419	1579	15480	510
7600	11725	1622	15895	524
7800	12031	1664	16309	538
8000	12337	1706	16723	552
8200	12648	1749	17146	565
8400	12960	1792	17569	579
8600	13272	1836	17991	593
8800	13584	1879	18414	607
9000	13896	1922	18837	620
9200	14196	1963	19244	634
9400	14497	2005	19652	648
9600	14797	2046	20059	662
9800	15098	2088	20467	676
10000	15399	2130	20874	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC MXT-20

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	2960	409	4013	104
1600	3158	437	4281	110
1800	3554	492	4818	124
2000	3950	546	5355	138
2200	4346	601	5891	152
2400	4742	656	6428	166
2600	5138	711	6965	179
2800	5534	765	7502	193
3000	5930	820	8039	207
3200	6325	875	8574	221
3400	6720	929	9110	235
3600	7115	984	9645	248
3800	7510	1039	10181	262
4000	7905	1093	10716	276
4200	8300	1148	11251	290
4400	8695	1203	11787	304
4600	9090	1257	12322	317
4800	9485	1312	12858	331
5000	9880	1366	13393	345
5200	10276	1421	13930	359
5400	10672	1476	14467	373
5600	11068	1531	15004	386
5800	11464	1585	15541	400
6000	11860	1640	16077	414
6200	12254	1695	16612	428
6400	12648	1749	17146	442
6600	13042	1804	17680	455
6800	13436	1858	18214	469
7000	13830	1913	18748	483
7200	14226	1967	19285	497
7400	14622	2022	19822	511
7600	15018	2077	20358	524
7800	15414	2132	20895	538
8000	15810	2187	21432	552
8200	16205	2241	21967	566
8400	16600	2296	22503	580
8600	16995	2350	23038	593
8800	17390	2405	23574	607
9000	17785	2460	24109	621
9200	18180	2514	24645	635
9400	18575	2569	25180	649
9600	18970	2624	25716	662
9800	19365	2678	26251	676
10000	19760	2733	26787	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC MXT-35

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	5400	747	7320	104
1600	5772	798	7825	110
1800	6516	901	8833	124
2000	7260	1004	9842	138
2200	8021	1109	10873	152
2400	8782	1215	11905	166
2600	9543	1320	12936	179
2800	10304	1425	13968	193
3000	11065	1530	15000	207
3200	11817	1634	16019	221
3400	12569	1738	17039	235
3600	13321	1842	18058	248
3800	14073	1946	19077	262
4000	14825	2050	20097	276
4200	15572	2154	21109	290
4400	16319	2257	22122	304
4600	17066	2360	23135	317
4800	17813	2464	24147	331
5000	18560	2567	25160	345
5200	19306	2670	26171	359
5400	20052	2773	27182	373
5600	20798	2876	28194	386
5800	21544	2980	29205	400
6000	22290	3083	30216	414
6200	23027	3185	31215	428
6400	23764	3287	32214	442
6600	24501	3388	33214	455
6800	25238	3490	34213	469
7000	25975	3592	35212	483
7200	26716	3695	36216	497
7400	27457	3797	37221	511
7600	28198	3900	38225	524
7800	28939	4002	39230	538
8000	29680	4105	40234	552
8200	30422	4207	41240	566
8400	31164	4310	42246	580
8600	31906	4413	43252	593
8800	32648	4515	44258	607
9000	33390	4618	45263	621
9200	34132	4720	46269	635
9400	34874	4823	47275	649
9600	35616	4926	48281	662
9800	35358	4890	47931	676
10000	37100	5131	50293	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC HY-.7 MXT SA

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	125	17	169	104
1600	132	18	179	110
1800	146	20	198	124
2000	161	22	218	138
2200	177	24	240	152
2400	194	27	263	166
2600	210	29	285	179
2800	227	31	308	193
3000	244	34	331	207
3200	260	36	352	221
3400	276	38	374	235
3600	293	41	397	248
3800	309	43	419	262
4000	325	45	441	276
4200	342	47	464	290
4400	358	50	485	304
4600	374	52	507	317
4800	391	54	530	331
5000	407	56	552	345
5200	423	59	573	359
5400	440	61	596	373
5600	456	63	618	386
5800	472	65	640	400
6000	489	68	663	414
6200	505	70	685	428
6400	522	72	708	442
6600	538	74	729	455
6800	554	77	751	469
7000	571	79	774	483
7200	587	81	796	497
7400	603	83	817	511
7600	619	86	839	524
7800	635	88	861	538
8000	651	90	882	552
8200	667	92	904	566
8400	684	95	927	580
8600	700	97	949	593
8800	716	99	971	607
9000	733	101	994	621
9200	748	103	1014	635
9400	764	106	1036	649
9600	780	108	1057	662
9800	796	110	1079	676
10000	812	112	1101	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC HY MXT-1 SA

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	200	28	271	104
1600	214	30	290	110
1800	242	33	328	124
2000	270	37	366	138
2200	297	41	403	152
2400	324	45	439	166
2600	351	49	476	179
2800	378	52	512	193
3000	405	56	549	207
3200	431	60	584	221
3400	457	63	620	235
3600	483	67	655	248
3800	509	70	690	262
4000	535	74	725	276
4200	562	78	762	290
4400	589	81	798	304
4600	616	85	835	317
4800	643	89	872	331
5000	670	93	908	345
5200	697	96	945	359
5400	724	100	981	373
5600	751	104	1018	386
5800	778	108	1055	400
6000	805	111	1091	414
6200	832	115	1128	428
6400	859	119	1164	442
6600	886	123	1201	455
6800	913	126	1238	469
7000	840	116	1139	483
7200	967	134	1311	497
7400	994	137	1347	511
7600	1021	141	1384	524
7800	1048	145	1421	538
8000	1074	149	1456	552
8200	1101	152	1493	566
8400	1127	156	1528	580
8600	1153	159	1563	593
8800	1179	163	1598	607
9000	1205	167	1633	621
9200	1232	170	1670	635
9400	1259	174	1707	649
9600	1286	178	1743	662
9800	1313	182	1780	676
10000	1340	185	1817	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC HY MXT-3 SA

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	835	115	1132	104
1600	890	123	1206	110
1800	1000	138	1356	124
2000	1110	154	1505	138
2200	1222	169	1657	152
2400	1334	184	1808	166
2600	1446	200	1960	179
2800	1558	215	2112	193
3000	1670	231	2264	207
3200	1782	246	2416	221
3400	1894	262	2568	235
3600	2006	277	2719	248
3800	2118	293	2871	262
4000	2230	308	3023	276
4200	2342	324	3175	290
4400	2454	339	3327	304
4600	2566	355	3478	317
4800	2678	370	3630	331
5000	2790	386	3782	345
5200	2902	401	3934	359
5400	3014	417	4086	373
5600	3126	432	4238	386
5800	3238	448	4389	400
6000	3350	463	4541	414
6200	3462	479	4693	428
6400	3574	494	4845	442
6600	3686	510	4997	455
6800	3798	525	5149	469
7000	3910	541	5300	483
7200	4022	556	5452	497
7400	4134	572	5604	511
7600	4246	587	5756	524
7800	4358	603	5908	538
8000	4470	618	6060	552
8200	4582	634	6211	566
8400	4694	649	6363	580
8600	4806	665	6515	593
8800	4918	680	6667	607
9000	5030	696	6819	621
9200	5142	711	6970	635
9400	5254	727	7122	649
9600	5366	742	7274	662
9800	5478	758	7426	676
10000	5590	773	7578	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC HY MXT-5 SA

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	835	115	1132	104
1600	890	123	1206	110
1800	1000	138	1356	124
2000	1110	154	1505	138
2200	1222	169	1657	152
2400	1334	184	1808	166
2600	1446	200	1960	179
2800	1558	215	2112	193
3000	1670	231	2264	207
3200	1782	246	2416	221
3400	1894	262	2568	235
3600	2006	277	2719	248
3800	2118	293	2871	262
4000	2230	308	3023	276
4200	2342	324	3175	290
4400	2454	339	3327	304
4600	2566	355	3478	317
4800	2678	370	3630	331
5000	2790	386	3782	345
5200	2902	401	3934	359
5400	3014	417	4086	373
5600	3126	432	4238	386
5800	3238	448	4389	400
6000	3350	463	4541	414
6200	3462	479	4693	428
6400	3574	494	4845	442
6600	3686	510	4997	455
6800	3798	525	5149	469
7000	3910	541	5300	483
7200	4022	556	5452	497
7400	4134	572	5604	511
7600	4246	587	5756	524
7800	4358	603	5908	538
8000	4470	618	6060	552
8200	4582	634	6211	566
8400	4694	649	6363	580
8600	4806	665	6515	593
8800	4918	680	6667	607
9000	5030	696	6819	621
9200	5142	711	6970	635
9400	5254	727	7122	649
9600	5366	742	7274	662
9800	5478	758	7426	676
10000	5590	773	7578	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC HY 10-MXT SA

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	1755	243	2379	104
1600	1864	258	2527	110
1800	2082	288	2822	124
2000	2300	318	3118	138
2200	2526	349	3424	152
2400	2752	381	3731	166
2600	2978	412	4037	179
2800	3204	443	4343	193
3000	3430	474	4650	207
3200	3656	506	4956	221
3400	3882	537	5262	235
3600	4108	568	5569	248
3800	4334	599	5875	262
4000	4560	631	6182	276
4200	4792	663	6496	290
4400	5024	695	6811	304
4600	5256	727	7125	317
4800	5488	759	7440	331
5000	5720	791	7754	345
5200	5948	823	8063	359
5400	6176	854	8372	373
5600	6404	886	8681	386
5800	6632	917	8990	400
6000	6860	949	9299	414
6200	7094	981	9617	428
6400	7328	1013	9934	442
6600	7562	1046	10251	455
6800	7796	1078	10568	469
7000	8030	1111	10885	483
7200	8264	1143	11203	497
7400	8498	1175	11520	511
7600	8732	1208	11837	524
7800	8966	1240	12154	538
8000	9200	1272	12472	552
8200	9432	1304	12786	566
8400	9664	1337	13101	580
8600	9896	1369	13415	593
8800	10128	1401	13730	607
9000	10360	1433	14044	621
9200	10592	1465	14359	635
9400	10824	1497	14673	649
9600	11056	1529	14988	662
9800	11288	1561	15302	676
10000	11520	1593	15617	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC MXTP-1

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	205	28	278	104
1600	219	30	297	110
1800	247	34	335	124
2000	275	38	373	138
2200	303	42	411	152
2400	331	46	449	166
2600	359	50	487	179
2800	388	54	526	193
3000	416	58	564	207
3200	444	61	602	221
3400	472	65	640	235
3600	500	69	678	248
3800	528	73	716	262
4000	556	77	754	276
4200	584	81	792	290
4400	612	85	830	304
4600	640	89	868	317
4800	668	92	906	331
5000	696	96	943	345
5200	724	100	981	359
5400	751	104	1018	373
5600	778	108	1055	386
5800	806	111	1093	400
6000	833	115	1129	414
6200	860	119	1166	428
6400	887	123	1202	442
6600	914	126	1239	455
6800	941	130	1276	469
7000	968	134	1312	483
7200	994	137	1347	497
7400	1021	141	1384	511
7600	1047	145	1419	524
7800	1074	149	1456	538
8000	1100	152	1491	552
8200	1126	156	1526	566
8400	1152	159	1562	580
8600	1179	163	1598	593
8800	1205	167	1633	607
9000	1231	170	1669	621
9200	1257	174	1704	635
9400	1282	177	1738	649
9600	1308	181	1773	662
9800	1334	184	1808	676
10000	1359	188	1842	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC MXTP-3

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	464	64	629	104
1600	498	69	675	110
1800	559	77	758	124
2000	622	86	843	138
2200	685	95	929	152
2400	748	103	1014	166
2600	812	112	1101	179
2800	875	121	1186	193
3000	938	130	1272	207
3200	1001	138	1357	221
3400	1064	147	1442	235
3600	1128	156	1529	248
3800	1191	165	1615	262
4000	1254	173	1700	276
4200	1317	182	1785	290
4400	1380	191	1871	304
4600	1444	200	1957	317
4800	1507	208	2043	331
5000	1570	217	2128	345
5200	1633	226	2214	359
5400	1696	235	2299	373
5600	1759	243	2385	386
5800	1822	252	2470	400
6000	1885	261	2555	414
6200	1948	269	2641	428
6400	2011	278	2726	442
6600	2074	287	2812	455
6800	2137	296	2897	469
7000	2200	304	2982	483
7200	2262	313	3066	497
7400	2324	321	3150	511
7600	2387	330	3236	524
7800	2449	339	3320	538
8000	2551	353	3458	552
8200	2572	356	3487	566
8400	2634	364	3571	580
8600	2695	373	3653	593
8800	2757	381	3737	607
9000	2818	390	3820	621
9200	2878	398	3901	635
9400	2938	406	3983	649
9600	2997	414	4063	662
9800	3057	423	4144	676
10000	3117	431	4225	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC MXTP-5

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	812	112	1101	104
1600	967	134	1311	110
1800	977	135	1324	124
2000	1087	150	1474	138
2200	1198	166	1624	152
2400	1308	181	1773	166
2600	1419	196	1924	179
2800	1529	211	2073	193
3000	1640	227	2223	207
3200	1751	242	2374	221
3400	1861	257	2523	235
3600	1972	273	2673	248
3800	2082	288	2822	262
4000	2193	303	2973	276
4200	2304	319	3123	290
4400	2415	334	3274	304
4600	2525	349	3423	317
4800	2636	365	3573	331
5000	2747	380	3724	345
5200	2857	395	3873	359
5400	2967	410	4022	373
5600	3078	426	4173	386
5800	3188	441	4322	400
6000	3298	456	4471	414
6200	3408	471	4620	428
6400	3517	486	4768	442
6600	3627	502	4917	455
6800	3736	517	5065	469
7000	3848	532	5216	483
7200	3953	547	5359	497
7400	4061	562	5505	511
7600	4188	579	5677	524
7800	4276	591	5797	538
8000	4383	606	5942	552
8200	4489	621	6085	566
8400	4594	635	6228	580
8600	4700	650	6371	593
8800	4805	665	6514	607
9000	4911	679	6657	621
9200	5013	693	6796	635
9400	5115	707	6934	649
9600	5218	722	7074	662
9800	5320	736	7212	676
10000	5422	750	7350	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC MXTP-10

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	1831	253	2482	104
1600	1954	270	2649	110
1800	2201	304	2984	124
2000	2448	339	3319	138
2200	2696	373	3655	152
2400	2944	407	3991	166
2600	3192	441	4327	179
2800	3440	476	4663	193
3000	3688	510	4999	207
3200	3935	544	5334	221
3400	4182	578	5669	235
3600	4430	613	6005	248
3800	4677	647	6340	262
4000	4924	681	6675	276
4200	5171	715	7010	290
4400	5418	749	7345	304
4600	5664	783	7678	317
4800	5911	817	8013	331
5000	6157	852	8346	345
5200	6402	885	8679	359
5400	6647	919	9011	373
5600	6892	953	9343	386
5800	7136	987	9674	400
6000	7381	1021	10006	414
6200	7622	1054	10332	428
6400	7862	1087	10658	442
6600	9103	1259	12340	455
6800	8343	1154	11310	469
7000	8584	1187	11636	483
7200	8823	1220	11960	497
7400	9063	1253	12286	511
7600	9302	1286	12610	524
7800	9542	1320	12935	538
8000	9781	1353	13259	552
8200	10021	1386	13584	566
8400	10260	1419	13908	580
8600	10500	1452	14234	593
8800	10740	1485	14559	607
9000	10979	1518	14883	621
9200	11213	1551	15200	635
9400	11447	1583	15518	649
9600	11680	1615	15833	662
9800	11914	1648	16151	676
10000	12148	1680	16468	690

This chart supercedes all prior version regarding this tool 03/31/2008

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HYTORC STEALTH-2

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	278	38	377	104
1600	297	41	403	110
1800	336	46	456	124
2000	375	52	509	138
2200	413	57	560	152
2400	450	62	610	166
2600	488	67	662	179
2800	525	73	712	193
3000	563	78	763	207
3200	600	83	814	221
3400	638	88	865	235
3600	675	93	915	248
3800	713	99	967	262
4000	750	104	1017	276
4200	787	109	1067	290
4400	825	114	1119	304
4600	862	119	1169	317
4800	900	124	1220	331
5000	937	130	1271	345
5200	974	135	1321	359
5400	1011	140	1371	373
5600	1048	145	1421	386
5800	1085	150	1471	400
6000	1122	155	1521	414
6200	1160	160	1573	428
6400	1198	166	1624	442
6600	1235	171	1675	455
6800	1273	176	1726	469
7000	1311	181	1778	483
7200	1348	186	1828	497
7400	1385	192	1878	511
7600	1421	197	1927	524
7800	1458	202	1977	538
8000	1495	207	2027	552
8200	1532	212	2077	566
8400	1570	217	2129	580
8600	1607	222	2179	593
8800	1645	228	2231	607
9000	1682	233	2281	621
9200	1719	238	2331	635
9400	1757	243	2382	649
9600	1794	248	2433	662
9800	1832	253	2484	676
10000	1869	258	2534	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC STEALTH-4

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	604	84	819	104
1600	644	89	873	110
1800	725	100	983	124
2000	806	111	1093	138
2200	885	122	1200	152
2400	964	133	1307	166
2600	1043	144	1414	179
2800	1122	155	1521	193
3000	1201	166	1629	207
3200	1281	177	1737	221
3400	1361	188	1846	235
3600	1442	199	1955	248
3800	1522	210	2064	262
4000	1602	222	2172	276
4200	1680	232	2278	290
4400	1758	243	2384	304
4600	1837	254	2491	317
4800	1915	265	2597	331
5000	1993	276	2703	345
5200	2075	287	2814	359
5400	2157	298	2925	373
5600	2240	310	3037	386
5800	2322	321	3149	400
6000	2404	332	3260	414
6200	2485	344	3370	428
6400	2566	355	3479	442
6600	2647	366	3589	455
6800	2728	377	3699	469
7000	2809	388	3809	483
7200	2887	399	3915	497
7400	2965	410	4021	511
7600	3042	421	4125	524
7800	3120	431	4231	538
8000	3198	442	4336	552
8200	3280	454	4448	566
8400	3362	465	4559	580
8600	3444	476	4670	593
8800	3526	488	4781	607
9000	3608	499	4892	621
9200	3690	510	5004	635
9400	3773	522	5116	649
9600	3855	533	5227	662
9800	3938	545	5340	676
10000	4020	556	5451	690

This chart supercedes all prior version regarding this tool 03/31/2008

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HYTORC STEALTH-8

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	1199	166	1626	104
1600	1276	176	1730	110
1800	1431	198	1940	124
2000	1585	219	2149	138
2200	1743	241	2364	152
2400	1901	263	2578	166
2600	2060	285	2793	179
2800	2218	307	3008	193
3000	2376	329	3222	207
3200	2539	351	3443	221
3400	2702	374	3664	235
3600	2865	396	3885	248
3800	3028	419	4106	262
4000	3191	441	4327	276
4200	3354	464	4548	290
4400	3517	486	4769	304
4600	3681	509	4991	317
4800	3844	532	5212	331
5000	4007	554	5433	345
5200	4172	577	5657	359
5400	4337	600	5881	373
5600	4502	623	6105	386
5800	4667	645	6328	400
6000	4832	668	6552	414
6200	4988	690	6764	428
6400	5145	712	6977	442
6600	5301	733	7188	455
6800	5458	755	7401	469
7000	5614	776	7613	483
7200	5773	798	7828	497
7400	5931	820	8042	511
7600	6090	842	8258	524
7800	6248	864	8472	538
8000	6407	886	8688	552
8200	6565	908	8902	566
8400	6723	930	9116	580
8600	6881	952	9331	593
8800	7039	973	9545	607
9000	7197	995	9759	621
9200	7354	1017	9972	635
9400	7512	1039	10186	649
9600	7669	1061	10399	662
9800	7827	1082	10613	676
10000	7984	1104	10826	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC STEALTH-14

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	2105	291	2854	104
1600	2247	311	3047	110
1800	2532	350	3433	124
2000	2817	390	3820	138
2200	3102	429	4206	152
2400	3386	468	4591	166
2600	3671	508	4978	179
2800	3955	547	5363	193
3000	4240	586	5749	207
3200	4525	626	6136	221
3400	4810	665	6522	235
3600	5094	705	6907	248
3800	5379	744	7294	262
4000	5664	783	7680	276
4200	5948	823	8065	290
4400	6232	862	8451	304
4600	6517	901	8837	317
4800	6801	941	9222	331
5000	7085	980	9607	345
5200	7372	1020	9996	359
5400	7659	1059	10386	373
5600	7945	1099	10773	386
5800	8232	1138	11163	400
6000	8519	1178	11552	414
6200	8805	1218	11940	428
6400	9091	1257	12327	442
6600	9377	1297	12715	455
6800	9663	1336	13103	469
7000	9949	1376	13491	483
7200	10237	1416	13881	497
7400	10525	1456	14272	511
7600	10814	1496	14664	524
7800	11102	1535	15054	538
8000	11390	1575	15445	552
8200	11676	1615	15833	566
8400	11962	1654	16220	580
8600	12248	1694	16608	593
8800	12534	1733	16996	607
9000	12820	1773	17384	621
9200	13107	1813	17773	635
9400	13394	1852	18162	649
9600	13681	1892	18551	662
9800	13968	1932	18941	676
10000	14255	1971	19330	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC STEALTH-22

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	3250	449	4407	104
1600	3472	480	4708	110
1800	3916	542	5310	124
2000	4360	603	5912	138
2200	4802	664	6512	152
2400	5244	725	7111	166
2600	5686	786	7710	179
2800	6128	848	8310	193
3000	6570	909	8909	207
3200	7000	968	9492	221
3400	7430	1028	10075	235
3600	7860	1087	10658	248
3800	8290	1147	11241	262
4000	8720	1206	11824	276
4200	9132	1263	12383	290
4400	9544	1320	12942	304
4600	9956	1377	13500	317
4800	10368	1434	14059	331
5000	10780	1491	14618	345
5200	11245	1555	15248	359
5400	11710	1619	15879	373
5600	12175	1684	16509	386
5800	12640	1748	17140	400
6000	13105	1812	17770	414
6200	13542	1873	18363	428
6400	13979	1933	18956	442
6600	14415	1994	19547	455
6800	14852	2054	20139	469
7000	15289	2114	20732	483
7200	15729	2175	21329	497
7400	16169	2236	21925	511
7600	16610	2297	22523	524
7800	17050	2358	23120	538
8000	17490	2419	23716	552
8200	17928	2479	24310	566
8400	18366	2540	24904	580
8600	18804	2601	25498	593
8800	19242	2661	26092	607
9000	19680	2722	26686	621
9200	20119	2782	27281	635
9400	20558	2843	27877	649
9600	20997	2904	28472	662
9800	21436	2965	29067	676
10000	21875	3025	29663	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC STEALTH-36

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	4917	680	6667	104
1600	5255	727	7126	110
1800	5931	820	8042	124
2000	6607	914	8959	138
2200	7309	1011	9911	152
2400	8012	1108	10864	166
2600	8715	1205	11818	179
2800	9417	1302	12769	193
3000	10120	1400	13723	207
3200	10814	1496	14664	221
3400	11508	1592	15605	235
3600	12202	1688	16546	248
3800	12896	1784	17487	262
4000	13590	1879	18428	276
4200	14295	1977	19384	290
4400	14999	2074	20339	304
4600	15704	2172	21295	317
4800	16409	2269	22251	331
5000	17113	2367	23205	345
5200	17819	2464	24163	359
5400	18525	2562	25120	373
5600	19230	2660	26076	386
5800	19936	2757	27033	400
6000	20642	2855	27991	414
6200	21354	2953	28956	428
6400	22066	3052	29921	442
6600	22778	3150	30887	455
6800	23490	3249	31852	469
7000	24202	3347	32818	483
7200	24914	3446	33783	497
7400	25627	3544	34750	511
7600	26340	3643	35717	524
7800	27057	3742	36689	538
8000	27765	3840	37649	552
8200	28462	3936	38594	566
8400	29159	4033	39540	580
8600	29856	4129	40485	593
8800	30553	4225	41430	607
9000	31250	4322	42375	621
9200	31944	4418	43316	635
9400	32639	4514	44258	649
9600	33333	4610	45200	662
9800	34028	4706	46142	676
10000	34722	4802	47083	690

This chart supercedes all prior version regarding this tool 03/31/2008

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HYTORC VERSA-1

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	150	21	240	104
1600	161	22	2318	110
1800	181	25	246	124
2000	202	28	274	138
2200	222	31	301	152
2400	243	34	239	165
2600	463	36	357	179
2800	284	39	385	193
3000	304	42	412	207
3200	326	45	442	220
3400	347	48	174	234
3600	369	51	500	248
3800	391	54	530	262
4000	412	57	559	276
4200	434	60	588	290
4400	455	63	616	303
4600	476	66	645	317
4800	497	69	574	331
5000	518	72	702	345
5200	539	75	731	358
5400	561	78	760	372
5600	582	80	789	386
5800	603	83	818	400
6000	625	86	847	414
6200	646	89	876	427
6400	668	92	905	441
6600	589	95	934	455
6800	711	98	964	468
7000	732	101	993	482
7200	753	104	1021	496
7400	774	107	1050	510
7600	796	110	1078	524
7800	817	113	1107	538
8000	838	116	1136	552
8200	759	119	1164	565
8400	880	122	1193	579
8600	901	125	1221	593
8800	922	128	1250	607
9000	943	130	1279	620
9200	964	133	1307	634
9400	986	136	1336	648
9600	1007	139	1365	662
9800	1025	142	1394	676
10000	1050	145	1423	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC VERSA-2 LINK 1-6

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	261	36	354	104
1600	279	39	378	110
1800	314	43	426	124
2000	349	48	473	138
2200	384	53	521	152
2400	419	58	568	166
2600	545	75	739	179
2800	489	68	663	193
3000	524	72	711	207
3200	559	77	758	221
3400	594	82	805	235
3600	629	87	853	248
3800	663	92	899	262
4000	698	97	946	276
4200	735	102	997	290
4400	771	107	1045	304
4600	807	112	1094	317
4800	844	117	1144	331
5000	880	122	1193	345
5200	916	127	1242	359
5400	952	132	1291	373
5600	988	137	1340	386
5800	1024	142	1389	400
6000	1060	147	1437	414
6200	1094	151	1483	428
6400	1128	156	1530	442
6600	1163	161	1577	455
6800	1197	166	1623	469
7000	1232	170	1671	483
7200	1269	176	1721	497
7400	1306	181	1771	511
7600	1344	186	1822	524
7800	1381	191	1873	538
8000	1418	196	1923	552
8200	1455	201	1973	566
8400	1491	206	2022	580
8600	1527	211	2071	593
8800	1564	216	2121	607
9000	1600	221	2170	621
9200	1636	226	2218	635
9400	1672	231	2267	649
9600	1708	236	2316	662
9800	1744	241	2365	676
10000	1780	246	2414	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC VERSA-2 LINK 7-8

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	278	38	377	104
1600	297	41	403	110
1800	336	46	456	124
2000	374	52	507	138
2200	412	57	559	152
2400	449	62	609	166
2600	487	67	660	179
2800	524	72	711	193
3000	562	78	762	207
3200	600	83	814	221
3400	638	88	865	235
3600	677	94	918	248
3800	715	99	970	262
4000	753	104	1021	276
4200	792	110	1074	290
4400	831	115	1127	304
4600	870	120	1180	317
4800	909	126	1233	331
5000	947	131	1284	345
5200	986	136	1337	359
5400	1025	142	1390	373
5600	1063	147	1441	386
5800	1102	152	1494	400
6000	1140	158	1546	414
6200	1179	163	1599	428
6400	1218	168	1652	442
6600	1256	174	1703	455
6800	1295	179	1756	469
7000	1334	184	1809	483
7200	1372	190	1860	497
7400	1411	195	1913	511
7600	1450	201	1966	524
7800	1488	206	2018	538
8000	1427	197	1935	552
8200	1566	217	2123	566
8400	1606	222	2178	580
8600	1645	228	2231	593
8800	1685	233	2285	607
9000	1724	238	2338	621
9200	1763	244	2391	635
9400	1802	249	2444	649
9600	1842	255	2498	662
9800	1881	260	2551	676
10000	1920	266	2604	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC VERSA-4

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	654	90	887	104
1600	700	97	949	110
1800	792	110	1074	124
2000	884	122	1199	138
2200	972	134	1318	152
2400	1060	147	1437	166
2600	1148	159	1557	179
2800	1236	171	1676	193
3000	1324	183	1795	207
3200	1415	196	1919	221
3400	1506	208	2042	235
3600	1597	221	2166	248
3800	1688	233	2289	262
4000	1779	246	2412	276
4200	1868	258	2533	290
4400	1958	271	2655	304
4600	2047	283	2776	317
4800	2137	296	2898	331
5000	2226	308	3018	345
5200	2319	321	3145	359
5400	2412	334	3271	373
5600	2505	346	3397	386
5800	2597	359	3522	400
6000	2690	372	3648	414
6200	2780	384	3770	428
6400	2869	397	3890	442
6600	2959	409	4012	455
6800	3048	422	4133	469
7000	3138	434	4255	483
7200	3229	447	4379	497
7400	3320	459	4502	511
7600	3411	472	4625	524
7800	3503	484	4750	538
8000	3594	497	4873	552
8200	3686	510	4998	566
8400	3779	523	5124	580
8600	3871	535	5249	593
8800	3963	548	5374	607
9000	4056	561	5500	621
9200	4145	573	5621	635
9400	4234	586	5741	649
9600	4324	598	5863	662
9800	4413	610	5984	676
10000	4503	623	6106	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC VERSA-4   SLIM ALL up to 2-3/8"

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	661	91	896	104
1600	706	98	957	110
1800	796	110	1079	124
2000	886	123	1201	138
2200	976	135	1323	152
2400	1067	148	1447	166
2600	1157	160	1569	179
2800	1248	173	1692	193
3000	1338	185	1814	207
3200	1429	198	1938	221
3400	1520	210	2061	235
3600	1611	223	2185	248
3800	1702	235	2308	262
4000	1793	248	2431	276
4200	1883	260	2553	290
4400	1974	273	2677	304
4600	2064	285	2799	317
4800	2155	298	2922	331
5000	2245	310	3044	345
5200	2335	323	3166	359
5400	2425	335	3288	373
5600	2515	348	3410	386
5800	2605	360	3532	400
6000	2695	373	3654	414
6200	2785	385	3776	428
6400	2874	397	3897	442
6600	2964	410	4019	455
6800	3054	422	4141	469
7000	3143	435	4262	483
7200	3234	447	4385	497
7400	3324	460	4507	511
7600	3415	472	4631	524
7800	3506	485	4754	538
8000	3597	497	4878	552
8200	3683	509	4994	566
8400	3770	521	5112	580
8600	3857	533	5230	593
8800	3943	545	5347	607
9000	4030	557	5465	621
9200	4118	570	5584	635
9400	4206	582	5703	649
9600	4294	594	5823	662
9800	4382	606	5942	676
10000	4469	618	6060	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC VERSA-4 SLIM 2-9/16" TO 3-1/2"

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	740	102	1003	104
1600	791	109	1073	110
1800	893	124	1211	124
2000	996	138	1351	138
2200	1098	152	1489	152
2400	1200	166	1627	166
2600	1302	180	1766	179
2800	1404	194	1904	193
3000	1507	208	2043	207
3200	1609	223	2182	221
3400	1712	237	2321	235
3600	1815	251	2461	248
3800	1918	265	2601	262
4000	2020	279	2739	276
4200	2124	294	2880	290
4400	2227	308	3020	304
4600	2331	322	3161	317
4800	2434	337	3301	331
5000	2537	351	3440	345
5200	2641	365	3581	359
5400	2744	379	3721	373
5600	2847	394	3861	386
5800	2950	408	4000	400
6000	3054	422	4141	414
6200	3157	437	4281	428
6400	3260	451	4421	442
6600	3364	465	4562	455
6800	3467	479	4701	469
7000	3570	494	4841	483
7200	3672	508	4979	497
7400	3774	522	5118	511
7600	3876	536	5256	524
7800	3978	550	5394	538
8000	4080	564	5532	552
8200	4183	579	5672	566
8400	4286	593	5812	580
8600	4389	607	5951	593
8800	4492	621	6091	607
9000	4595	635	6231	621
9200	4696	649	6368	635
9400	4798	664	6506	649
9600	4899	678	6643	662
9800	5000	692	6780	676
10000	5101	705	6917	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC VERSA-8

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	1350	187	1831	104
1600	1440	199	1953	110
1800	1620	224	2197	124
2000	1800	249	2441	138
2200	1980	274	2685	152
2400	2160	299	2929	166
2600	2340	324	3173	179
2800	2520	349	3417	193
3000	2700	373	3661	207
3200	2880	398	3905	221
3400	3060	423	4149	235
3600	3240	448	4393	248
3800	3420	473	4638	262
4000	3600	498	4882	276
4200	3780	523	5126	290
4400	3960	548	5370	304
4600	4140	573	5614	317
4800	4320	597	5858	331
5000	4500	622	6102	345
5200	4680	647	6346	359
5400	4860	672	6590	373
5600	5040	697	6834	386
5800	5220	722	7078	400
6000	5400	747	7322	414
6200	5580	772	7566	428
6400	5760	797	7811	442
6600	5940	822	8055	455
6800	6120	846	8299	469
7000	6300	871	8543	483
7200	6480	896	8787	497
7400	6660	921	9031	511
7600	6840	946	9275	524
7800	7020	971	9519	538
8000	7200	996	9763	552
8200	7380	1021	10007	566
8400	7560	1046	10251	580
8600	7740	1070	10495	593
8800	7920	1095	10740	607
9000	8100	1120	10984	621
9200	8280	1145	11228	635
9400	8460	1170	11472	649
9600	8640	1195	11716	662
9800	8820	1220	11960	676
10000	9000	1245	12204	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC VERSA-8 SLIM #2-3

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	1295	179	1756	104
1600	1388	192	1882	110
1800	1573	218	2133	124
2000	1758	243	2384	138
2200	1933	267	2621	152
2400	2109	292	2860	166
2600	2284	316	3097	179
2800	2460	340	3336	193
3000	2635	364	3573	207
3200	2817	390	3820	221
3400	2999	415	4067	235
3600	3181	440	4313	248
3800	3363	465	4560	262
4000	3545	490	4807	276
4200	3722	515	5047	290
4400	3899	539	5287	304
4600	4077	564	5528	317
4800	4254	588	5768	331
5000	4431	613	6008	345
5200	4607	637	6247	359
5400	4783	661	6486	373
5600	4959	686	6724	386
5800	5135	710	6963	400
6000	5311	735	7202	414
6200	5489	759	7443	428
6400	5666	784	7683	442
6600	5844	808	7924	455
6800	6022	833	8166	469
7000	6200	857	8407	483
7200	6380	882	8651	497
7400	6560	907	8895	511
7600	6740	932	9139	524
7800	6920	957	9384	538
8000	7100	982	9628	552
8200	7273	1006	9862	566
8400	7446	1030	10097	580
8600	7618	1054	10330	593
8800	7791	1077	10565	607
9000	7963	1101	10798	621
9200	8140	1126	11038	635
9400	8317	1150	11278	649
9600	8494	1175	11518	662
9800	8671	1199	11758	676
10000	8848	1224	11998	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC VERSA-8 SLIM #4-9

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	1457	202	1976	104
1600	1564	216	2121	110
1800	1779	246	2412	124
2000	1994	276	2704	138
2200	2187	302	2966	152
2400	2381	329	3229	166
2600	2574	356	3490	179
2800	2767	383	3752	193
3000	2960	409	4014	207
3200	3178	440	4309	221
3400	3395	470	4604	235
3600	3613	500	4899	248
3800	3830	530	5193	262
4000	4048	560	5489	276
4200	4235	586	5743	290
4400	4422	612	5996	304
4600	4610	638	6251	317
4800	4797	663	6505	331
5000	4984	689	6758	345
5200	5184	717	7030	359
5400	5383	744	7299	373
5600	5582	772	7569	386
5800	5781	800	7839	400
6000	5980	827	8109	414
6200	6181	855	8381	428
6400	6381	882	8653	442
6600	6581	910	8924	455
6800	6781	938	9195	469
7000	6981	965	9466	483
7200	7179	993	9735	497
7400	7376	1020	10002	511
7600	7574	1047	10270	524
7800	7772	1075	10539	538
8000	7970	1102	10807	552
8200	8169	1130	11077	566
8400	8369	1157	11348	580
8600	8568	1185	11618	593
8800	8768	1213	11889	607
9000	8968	1240	12161	621
9200	9166	1268	12429	635
9400	9364	1295	12698	649
9600	9562	1322	12966	662
9800	9760	1350	13235	676
10000	9958	1377	13503	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC VERSA-14

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	2153	298	2918	104
1600	2294	317	3110	110
1800	2577	356	3494	124
2000	2861	396	3878	138
2200	3153	436	4274	152
2400	3445	477	4671	165
2600	3738	517	5067	179
2800	4030	557	5463	193
3000	4323	598	5860	207
3200	4624	640	6269	220
3400	4926	681	6678	234
3600	5228	723	7087	248
3800	5530	765	7496	262
4000	5831	806	7905	276
4200	6133	848	8313	290
4400	6434	890	8722	303
4600	6735	931	9130	317
4800	7037	973	9539	331
5000	7338	1015	9947	345
5200	7651	1058	10372	358
5400	7964	1101	10797	372
5600	8278	1145	11221	386
5800	8591	1188	11646	400
6000	8904	1231	12070	414
6200	9199	1272	12471	427
6400	9495	1313	12871	441
6600	9790	1354	13272	455
6800	10086	1395	13672	468
7000	10381	1436	14073	482
7200	10685	1478	14485	496
7400	10989	1520	14896	510
7600	11293	1562	15308	524
7800	11596	1604	15720	538
8000	11900	1646	16132	552
8200	12194	1686	16530	565
8400	12488	1727	16928	579
8600	12782	1768	17327	593
8800	13075	1808	17725	607
9000	13369	1849	18123	620
9200	13694	1894	18563	634
9400	14018	1939	19003	648
9600	14343	1984	19443	662
9800	14667	2029	19883	676
10000	14992	2073	20323	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC HY-2XLCT w/ Hex Link

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	243	34	330	104
1600	259	36	351	110
1800	292	40	396	124
2000	325	45	441	138
2200	359	50	487	152
2400	392	54	532	166
2600	426	59	578	179
2800	459	63	622	193
3000	493	68	669	207
3200	526	73	713	221
3400	559	77	758	235
3600	591	82	801	248
3800	624	86	846	262
4000	657	91	891	276
4200	691	96	937	290
4400	726	100	984	304
4600	760	105	1031	317
4800	795	110	1078	331
5000	829	115	1124	345
5200	863	119	1170	359
5400	897	124	1216	373
5600	931	129	1262	386
5800	965	133	1309	400
6000	999	138	1355	414
6200	1033	143	1401	428
6400	1067	148	1447	442
6600	1102	152	1494	455
6800	1136	157	1540	469
7000	1170	162	1587	483
7200	1204	167	1633	497
7400	1239	171	1680	511
7600	1273	176	1726	524
7800	1308	181	1774	538
8000	1342	186	1820	552
8200	1377	190	1867	566
8400	1412	195	1915	580
8600	1446	200	1961	593
8800	1481	205	2008	607
9000	1516	210	2056	621
9200	1550	214	2102	635
9400	1584	219	2148	649
9600	1619	224	2195	662
9800	1653	229	2241	676
10000	1687	233	2288	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC HY-4XLCT w/ Hex Link

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	580	80	786	104
1600	618	85	838	110
1800	694	96	941	124
2000	770	106	1044	138
2200	847	117	1149	152
2400	924	128	1253	166
2600	1001	138	1357	179
2800	1078	149	1462	193
3000	1155	160	1566	207
3200	1232	170	1671	221
3400	1309	181	1775	235
3600	1386	192	1879	248
3800	1463	202	1984	262
4000	1540	213	2088	276
4200	1618	224	2194	290
4400	1696	235	2300	304
4600	1774	245	2406	317
4800	1852	256	2511	331
5000	1930	267	2617	345
5200	2007	278	2721	359
5400	2084	288	2826	373
5600	2161	299	2930	386
5800	2238	310	3035	400
6000	2315	320	3139	414
6200	2392	331	3244	428
6400	2469	341	3348	442
6600	2546	352	3452	455
6800	2623	363	3557	469
7000	2700	373	3661	483
7200	2777	384	3766	497
7400	2854	395	3870	511
7600	2931	405	3974	524
7800	3008	416	4079	538
8000	3085	427	4183	552
8200	3163	437	4289	566
8400	3241	448	4395	580
8600	3319	459	4501	593
8800	3397	470	4606	607
9000	3475	481	4712	621
9200	3551	491	4815	635
9400	3627	502	4918	649
9600	3703	512	5021	662
9800	3779	523	5124	676
10000	3855	533	5227	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC HY-8XLCT w/ Hex Link

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	1143	158	1550	104
1600	1234	171	1673	110
1800	1417	196	1921	124
2000	1600	221	2170	138
2200	1754	243	2378	152
2400	1907	264	2586	166
2600	2061	285	2795	179
2800	2214	306	3002	193
3000	2368	327	3211	207
3200	2533	350	3435	221
3400	2698	373	3658	235
3600	2864	396	3884	248
3800	3029	419	4107	262
4000	3194	442	4331	276
4200	3358	464	4553	290
4400	3522	487	4776	304
4600	3685	510	4997	317
4800	3849	532	5219	331
5000	4013	555	5442	345
5200	4176	578	5663	359
5400	4340	600	5885	373
5600	4503	623	6106	386
5800	4667	645	6328	400
6000	4830	668	6549	414
6200	4996	691	6775	428
6400	5161	714	6998	442
6600	5327	737	7223	455
6800	5492	760	7447	469
7000	5658	783	7672	483
7200	5825	806	7899	497
7400	5992	829	8125	511
7600	6158	852	8350	524
7800	6325	875	8577	538
8000	6492	898	8803	552
8200	6658	921	9028	566
8400	6823	944	9252	580
8600	6989	967	9477	593
8800	7154	989	9701	607
9000	7320	1012	9926	621
9200	7486	1035	10151	635
9400	7652	1058	10376	649
9600	7819	1081	10603	662
9800	7985	1104	10828	676
10000	8151	1127	11053	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC HY-14XLCT w/ Hex Link

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	2010	278	2726	104
1600	2144	297	2907	110
1800	2412	334	3271	124
2000	2680	371	3634	138
2200	2984	413	4046	152
2400	3216	445	4361	166
2600	3484	482	4724	179
2800	3752	519	5088	193
3000	4020	556	5451	207
3200	4288	593	5815	221
3400	4556	630	6178	235
3600	4824	667	6541	248
3800	5092	704	6905	262
4000	5360	741	7268	276
4200	5628	778	7632	290
4400	5896	815	7995	304
4600	6164	852	8358	317
4800	6432	890	8722	331
5000	6700	927	9085	345
5200	6968	964	9449	359
5400	7236	1001	9812	373
5600	7504	1038	10175	386
5800	7772	1075	10539	400
6000	8040	1112	10902	414
6200	8308	1149	11266	428
6400	8576	1186	11629	442
6600	8844	1223	11992	455
6800	9112	1260	12356	469
7000	9380	1297	12719	483
7200	9648	1334	13083	497
7400	9916	1371	13446	511
7600	10184	1408	13810	524
7800	10452	1446	14173	538
8000	10720	1483	14536	552
8200	10988	1520	14900	566
8400	11256	1557	15263	580
8600	11524	1594	15627	593
8800	11795	1631	15994	607
9000	12060	1668	16353	621
9200	12328	1705	16717	635
9400	12596	1742	17080	649
9600	12864	1779	17444	662
9800	13132	1816	17807	676
10000	13400	1853	18170	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC HY-18XLCT w/ Hex Link

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	2676	370	3629	104
1600	2854	395	3870	110
1800	3209	444	4351	124
2000	3565	493	4834	138
2200	3922	542	5318	152
2400	4279	592	5802	166
2600	4636	641	6286	179
2800	4993	691	6771	193
3000	5350	740	7255	207
3200	5708	789	7740	221
3400	6066	839	8225	235
3600	6424	888	8711	248
3800	6782	938	9196	262
4000	7140	987	9682	276
4200	7496	1037	10165	290
4400	7852	1086	10647	304
4600	8208	1135	11130	317
4800	8564	1184	11613	331
5000	8920	1234	12096	345
5200	9277	1283	12580	359
5400	9634	1332	13064	373
5600	9991	1382	13548	386
5800	10348	1431	14032	400
6000	10705	1481	14516	414
6200	11062	1530	15000	428
6400	11419	1579	15484	442
6600	11776	1629	15968	455
6800	12133	1678	16452	469
7000	12490	1727	16936	483
7200	12848	1777	17422	497
7400	13206	1826	17907	511
7600	13564	1876	18393	524
7800	13922	1925	18878	538
8000	14280	1975	19364	552
8200	14637	2024	19848	566
8400	14994	2074	20332	580
8600	15351	2123	20816	593
8800	15708	2172	21300	607
9000	16065	2222	21784	621
9200	16421	2271	22267	635
9400	16777	2320	22750	649
9600	17133	2369	23232	662
9800	17489	2419	23715	676
10000	17845	2468	24198	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC HY-30XLCT w/ Hex Link

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	4579	633	6207	104
1600	4890	676	6626	110
1800	5513	762	7476	124
2000	6135	848	8319	138
2200	6759	935	9165	152
2400	7383	1021	10011	166
2600	8008	1108	10859	179
2800	8632	1194	11705	193
3000	9256	1280	12551	207
3200	9881	1367	13399	221
3400	10506	1453	14246	235
3600	11132	1540	15095	248
3800	11757	1626	15942	262
4000	12382	1712	16790	276
4200	13001	1798	17629	290
4400	13620	1884	18469	304
4600	14239	1969	19308	317
4800	14858	2055	20147	331
5000	15477	2140	20987	345
5200	16105	2227	21838	359
5400	16733	2314	22690	373
5600	17361	2401	23542	386
5800	17989	2488	24393	400
6000	18617	2575	25245	414
6200	19230	2660	26076	428
6400	19843	2744	26907	442
6600	20456	2829	27738	455
6800	21069	2914	28570	469
7000	21682	2999	29401	483
7200	22299	3084	30237	497
7400	22916	3169	31074	511
7600	23532	3254	31909	524
7800	24149	3340	32746	538
8000	24766	3425	33583	552
8200	25408	3514	34453	566
8400	26050	3603	35324	580
8600	26692	3692	36194	593
8800	27334	3780	37065	607
9000	27976	3869	37935	621
9200	28578	3952	38752	635
9400	28190	3899	38226	649
9600	29782	4119	40384	662
9800	30384	4202	41201	676
10000	30986	4285	42017	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC HY-45XLCT w/Hex Link

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	7130	986	9665	104
1600	7642	1057	10356	110
1800	8666	1199	11751	124
2000	9690	1340	13140	138
2200	10702	1480	14512	152
2400	11714	1620	15884	166
2600	12726	1760	17256	179
2800	13738	1900	18629	193
3000	14750	2040	20001	207
3200	15741	2177	21345	221
3400	16732	2314	22689	235
3600	17723	2451	24032	248
3800	18714	2588	25376	262
4000	19705	2725	26720	276
4200	20692	2862	28058	290
4400	21679	2998	29397	304
4600	22666	3135	30735	317
4800	23653	3271	32073	331
5000	24640	3408	33412	345
5200	25646	3547	34776	359
5400	26652	3686	36140	373
5600	27658	3825	37504	386
5800	28664	3964	38868	400
6000	29670	4103	40233	414
6200	30606	4233	41502	428
6400	31542	4362	42771	442
6600	32478	4492	44040	455
6800	33414	4621	45309	469
7000	34350	4751	46579	483
7200	35349	4889	47933	497
7400	36348	5027	49288	511
7600	37347	5165	50643	524
7800	38346	5303	51997	538
8000	39345	5441	53352	552
8200	40328	5577	54685	566
8400	41311	5713	56018	580
8600	42294	5849	57351	593
8800	43277	5985	58684	607
9000	44260	6121	60017	621
9200	45244	6257	61351	635
9400	46228	6393	62685	649
9600	47212	6529	64019	662
9800	48196	6666	65354	676
10000	49180	6802	66688	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC HY-.5XLT

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	55	8	75	104
1600	59	8	80	110
1800	67	9	91	124
2000	75	10	102	138
2200	83	11	113	152
2400	92	13	125	166
2600	100	14	136	179
2800	109	15	148	193
3000	117	16	159	207
3200	125	17	169	221
3400	133	18	180	235
3600	140	19	190	248
3800	148	20	201	262
4000	156	22	211	276
4200	164	23	222	290
4400	172	24	233	304
4600	181	25	245	317
4800	189	26	256	331
5000	197	27	267	345
5200	206	28	279	359
5400	215	30	291	373
5600	223	31	302	386
5800	232	32	314	400
6000	241	33	327	414
6200	249	34	338	428
6400	257	36	348	442
6600	266	37	361	455
6800	274	38	371	469
7000	282	39	382	483
7200	289	40	392	497
7400	296	41	401	511
7600	304	42	412	524
7800	311	43	422	538
8000	318	44	431	552
8200	326	45	442	566
8400	334	46	453	580
8600	342	47	464	593
8800	350	48	474	607
9000	358	50	485	621
9200	366	51	496	635
9400	374	52	507	649
9600	381	53	516	662
9800	389	54	527	676
10000	397	55	538	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC HY-1XLT

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	200	28	271	104
1600	214	30	290	110
1800	242	33	328	124
2000	270	37	366	138
2200	297	41	403	152
2400	324	45	439	166
2600	351	49	476	179
2800	378	52	512	193
3000	405	56	549	207
3200	431	60	584	221
3400	457	63	620	235
3600	483	67	655	248
3800	509	70	690	262
4000	535	74	725	276
4200	562	78	762	290
4400	589	81	798	304
4600	616	85	835	317
4800	643	89	872	331
5000	670	93	908	345
5200	697	96	945	359
5400	724	100	981	373
5600	751	104	1018	386
5800	778	108	1055	400
6000	805	111	1091	414
6200	832	115	1128	428
6400	859	119	1164	442
6600	886	123	1201	455
6800	913	126	1238	469
7000	940	130	1274	483
7200	967	134	1311	497
7400	994	137	1347	511
7600	1021	141	1384	524
7800	1048	145	1421	538
8000	1075	149	1457	552
8200	1101	152	1493	566
8400	1127	156	1528	580
8600	1153	159	1563	593
8800	1179	163	1598	607
9000	1205	167	1633	621
9200	1232	170	1670	635
9400	1259	174	1707	649
9600	1286	178	1743	662
9800	1313	182	1780	676
10000	1340	185	1817	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC HY-3XLT

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	480	66	651	104
1600	512	71	694	110
1800	576	80	781	124
2000	640	89	868	138
2200	704	97	954	152
2400	768	106	1041	166
2600	832	115	1128	179
2800	896	124	1215	193
3000	960	133	1301	207
3200	1024	142	1388	221
3400	1088	150	1475	235
3600	1152	159	1562	248
3800	1216	168	1648	262
4000	1280	177	1735	276
4200	1346	186	1825	290
4400	1412	195	1914	304
4600	1478	204	2004	317
4800	1544	214	2093	331
5000	1610	223	2183	345
5200	1674	232	2269	359
5400	1738	240	2356	373
5600	1802	249	2443	386
5800	1866	258	2530	400
6000	1930	267	2616	414
6200	1994	276	2703	428
6400	2058	285	2790	442
6600	2122	293	2877	455
6800	2186	302	2963	469
7000	2250	311	3050	483
7200	2316	320	3140	497
7400	2382	329	3229	511
7600	2448	339	3319	524
7800	2514	348	3408	538
8000	2580	357	3497	552
8200	2646	366	3587	566
8400	2712	375	3676	580
8600	2778	384	3766	593
8800	2844	393	3855	607
9000	2910	402	3945	621
9200	2974	411	4032	635
9400	3038	420	4118	649
9600	3102	429	4205	662
9800	3166	438	4292	676
10000	3230	447	4379	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC HY-5XLT

PRESSURE/TORQUE CONVERSION CHART

PRESSURE IN PSI	FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	835	115	1132	104
1600	890	123	1206	110
1800	1000	138	1356	124
2000	1110	154	1505	138
2200	1222	169	1657	152
2400	1334	184	1808	166
2600	1446	200	1960	179
2800	1558	215	2112	193
3000	1670	231	2264	207
3200	1782	246	2416	221
3400	1894	262	2568	235
3600	2006	277	2719	248
3800	2118	293	2871	262
4000	2230	308	3023	276
4200	2342	324	3175	290
4400	2454	339	3327	304
4600	2566	355	3478	317
4800	2678	370	3630	331
5000	2790	386	3782	345
5200	2902	401	3934	359
5400	3014	417	4086	373
5600	3126	432	4238	386
5800	3238	448	4389	400
6000	3350	463	4541	414
6200	3462	479	4693	428
6400	3574	494	4845	442
6600	3686	510	4997	455
6800	3798	525	5149	469
7000	3910	541	5300	483
7200	4022	556	5452	497
7400	4134	572	5604	511
7600	4246	587	5756	524
7800	4358	603	5908	538
8000	4470	618	6060	552
8200	4582	634	6211	566
8400	4694	649	6363	580
8600	4806	665	6515	593
8800	4918	680	6667	607
9000	5030	696	6819	621
9200	5142	711	6970	635
9400	5254	727	7122	649
9600	5366	742	7274	662
9800	5478	758	7426	676
10000	5590	773	7578	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC HY-8XLT

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART FT. LBS.	KGM	NM	PRESSURE IN BAR
1500	1200	166	1627	104
1600	1280	177	1735	110
1800	1440	199	1952	124
2000	1600	221	2169	138
2200	1760	243	2386	152
2400	1920	266	2603	166
2600	2080	288	2820	179
2800	2240	310	3037	193
3000	2400	332	3253	207
3200	2560	354	3470	221
3400	2720	376	3687	235
3600	2880	398	3904	248
3800	3040	420	4121	262
4000	3200	443	4338	276
4200	3360	465	4555	290
4400	3520	487	4772	304
4600	3680	509	4989	317
4800	3840	531	5206	331
5000	4000	553	5422	345
5200	4160	575	5639	359
5400	4320	597	5856	373
5600	4480	620	6073	386
5800	4640	642	6290	400
6000	4800	664	6507	414
6200	4960	686	6724	428
6400	5120	708	6941	442
6600	5280	730	7158	455
6800	5440	752	7374	469
7000	5600	774	7591	483
7200	5760	797	7808	497
7400	5920	819	8025	511
7600	6080	841	8242	524
7800	6240	863	8459	538
8000	6400	885	8676	552
8200	6560	907	8893	566
8400	6720	929	9110	580
8600	6880	952	9327	593
8800	7040	974	9543	607
9000	7200	996	9760	621
9200	7360	1018	9977	635
9400	7520	1040	10194	649
9600	7680	1062	10411	662
9800	7840	1084	10628	676
10000	8000	1106	10845	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC HY-10XLT

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	1755	243	2379	104
1600	1864	258	2527	110
1800	2082	288	2822	124
2000	2300	318	3118	138
2200	2526	349	3424	152
2400	2752	381	3731	166
2600	2978	412	4037	179
2800	3204	443	4343	193
3000	3430	474	4650	207
3200	3656	506	4956	221
3400	3882	537	5262	235
3600	4108	568	5569	248
3800	4334	599	5875	262
4000	4560	631	6182	276
4200	4792	663	6496	290
4400	5024	695	6811	304
4600	5256	727	7125	317
4800	5488	759	7440	331
5000	5720	791	7754	345
5200	5948	823	8063	359
5400	6176	854	8372	373
5600	6404	886	8681	386
5800	6632	917	8990	400
6000	6860	949	9299	414
6200	7094	981	9617	428
6400	7328	1013	9934	442
6600	7562	1046	10251	455
6800	7796	1078	10568	469
7000	8030	1111	10885	483
7200	8264	1143	11203	497
7400	8498	1175	11520	511
7600	8732	1208	11837	524
7800	8966	1240	12154	538
8000	9200	1272	12472	552
8200	9432	1304	12786	566
8400	9664	1337	13101	580
8600	9896	1369	13415	593
8800	10128	1401	13730	607
9000	10360	1433	14044	621
9200	10592	1465	14359	635
9400	10824	1497	14673	649
9600	11056	1529	14988	662
9800	11288	1561	15302	676
10000	11520	1593	15617	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC

HYTORC HY-20XLT

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	2960	409	4013	104
1600	3158	437	4281	110
1800	3554	492	4818	124
2000	3950	546	5355	138
2200	4346	601	5891	152
2400	4742	656	6428	166
2600	5138	711	6965	179
2800	5534	765	7502	193
3000	5930	820	8039	207
3200	6325	875	8574	221
3400	6720	929	9110	235
3600	7115	984	9645	248
3800	7510	1039	10181	262
4000	7905	1093	10716	276
4200	8300	1148	11251	290
4400	8695	1203	11787	304
4600	9090	1257	12322	317
4800	9485	1312	12858	331
5000	9880	1366	13393	345
5200	10276	1421	13930	359
5400	10672	1476	14467	373
5600	11068	1531	15004	386
5800	11464	1585	15541	400
6000	11860	1640	16077	414
6200	12254	1695	16612	428
6400	12648	1749	17146	442
6600	13042	1804	17680	455
6800	13436	1858	18214	469
7000	13830	1913	18748	483
7200	14226	1967	19285	497
7400	14622	2022	19822	511
7600	15018	2077	20358	524
7800	15414	2132	20895	538
8000	15810	2187	21432	552
8200	16205	2241	21967	566
8400	16600	2296	22503	580
8600	16995	2350	23038	593
8800	17390	2405	23574	607
9000	17785	2460	24109	621
9200	18180	2514	24645	635
9400	18575	2569	25180	649
9600	18970	2624	25716	662
9800	19365	2678	26251	676
10000	19760	2733	26787	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC HY-25XLT

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	200	28	271	104
1600	214	30	290	110
1800	242	33	328	124
2000	270	37	366	138
2200	297	41	403	152
2400	324	45	439	166
2600	351	49	476	179
2800	378	52	512	193
3000	405	56	549	207
3200	431	60	584	221
3400	457	63	620	235
3600	483	67	655	248
3800	509	70	690	262
4000	535	74	725	276
4200	562	78	762	290
4400	589	81	798	304
4600	616	85	835	317
4800	643	89	872	331
5000	670	93	908	345
5200	697	96	945	359
5400	724	100	981	373
5600	751	104	1018	386
5800	778	108	1055	400
6000	805	111	1091	414
6200	832	115	1128	428
6400	859	119	1164	442
6600	886	123	1201	455
6800	913	126	1238	469
7000	940	130	1274	483
7200	967	134	1311	497
7400	994	137	1347	511
7600	1021	141	1384	524
7800	1048	145	1421	538
8000	1075	149	1457	552
8200	1101	152	1493	566
8400	1127	156	1528	580
8600	1153	159	1563	593
8800	1179	163	1598	607
9000	1205	167	1633	621
9200	1232	170	1670	635
9400	1259	174	1707	649
9600	1286	178	1743	662
9800	1313	182	1780	676
10000	1340	185	1817	690

This chart supercedes all prior version regarding this tool 03/31/2008

HYTORC HY-50XLT

PRESSURE IN PSI	PRESSURE/TORQUE CONVERSION CHART			PRESSURE IN BAR
	FT. LBS.	KGM	NM	
1500	7875	1089	10675	104
1600	8400	1162	11387	110
1800	9450	1307	12810	124
2000	10500	1452	14234	138
2200	11550	1597	15657	152
2400	12600	1743	17081	166
2600	13650	1888	18504	179
2800	14700	2033	19927	193
3000	15750	2178	21351	207
3200	16800	2323	22774	221
3400	17850	2469	24197	235
3600	18900	2614	25621	248
3800	19950	2759	27044	262
4000	21000	2904	28468	276
4200	22050	3050	29891	290
4400	23100	3195	31314	304
4600	24150	3340	32738	317
4800	25200	3485	34161	331
5000	26250	3630	35585	345
5200	27300	3776	37008	359
5400	28350	3921	38431	373
5600	29400	4066	39855	386
5800	30450	4211	41278	400
6000	31500	4356	42701	414
6200	32550	4502	44125	428
6400	33600	4647	45548	442
6600	34650	4792	46972	455
6800	35700	4937	48395	469
7000	36750	5083	49818	483
7200	37800	5228	51242	497
7400	38850	5373	52665	511
7600	39900	5518	54088	524
7800	40950	5663	55512	538
8000	42000	5809	56935	552
8200	43050	5954	58359	566
8400	44100	6099	59782	580
8600	45150	6244	61205	593
8800	46200	6389	62629	607
9000	47250	6535	64052	621
9200	48300	6680	65475	635
9400	49350	6825	66899	649
9600	50400	6970	68322	662
9800	51450	7116	69746	676
10000	52500	7261	71169	690

This chart supercedes all prior version regarding this tool 03/31/2008

Bolt Tightening Sequence: Why it Matters

There are many different things that determine whether a new flange connection will be secure and leak-free. One of the most important is the bolt tightening sequence.

To a new bolting apprentice, this may seem straightforward enough. But simply applying full torque to your first bolt and then moving onto the adjacent one is the wrong approach! The order in which you tighten the bolts and the load applied has a huge effect on the integrity of the joint.

Bolt Tightening Sequence: Why it Matters

To complete a flange joint securely, it is essential to control the stress variation in the flange joint components. In the case of the gasket, this needs to be compressed evenly across the flange face. If you were to tighten adjacent bolts when those opposite remain loose the result will be uneven compression and possible damage to the gasket.

The flanges must be brought together slowly and be parallel. In practice, this means starting by using the correct bolt tightening pattern at partial load, and then carrying out several more bolt passes, increasing the load each time.

Bolt Tightening Patterns

The ASME (American Society of Mechanical Engineers) PCC-1-2019 standard is the ‘go-to’ document for bolting standards. This gives multiple options for tightening sequences which if followed correctly will help to ensure a leak free flange joint. Showing all patterns for each flange size could be covered in great detail in a separate article. But to act as an overview, some examples are as described below.

Legacy Pattern and Modified Legacy Bolting Patterns

Before they are tightened, bolts can be numbered sequentially (1,2,3,4 etc) in a clockwise direction around the flange (fig 1 below). Or they can be numbered by the order of tightening (fig 2 below). Both methods have their advantages – but it is important that the one chosen is agreed in pre-job briefs and that the tightening crews are suitably trained.

Legacy Numbering Sequence

In following the example shown in fig 1, bolt numbering can be carried out easily (clockwise 1,2,3,4 etc), but the technician who does the tightening needs to be experienced enough to follow the corr ect sequence (e.g. 1,7,4,10).

Alternative to Legacy Numbering Sequence

In fig 2 the situation is the r everse. Numbering should be done by a technician with the relevant experience. The crew members who do the tightening then simply follow the right numerical sequence (bolts 1,2,3,4 etc).

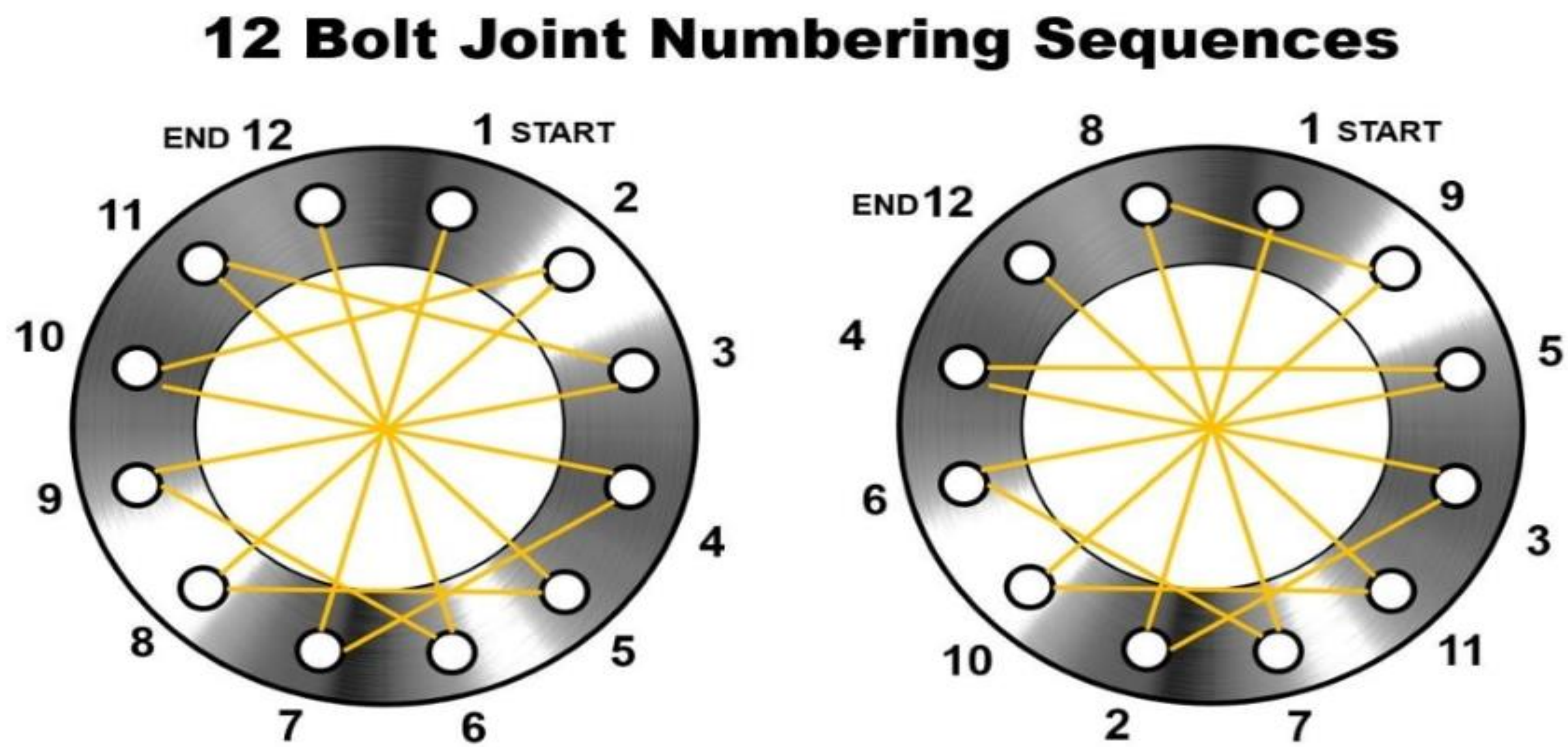
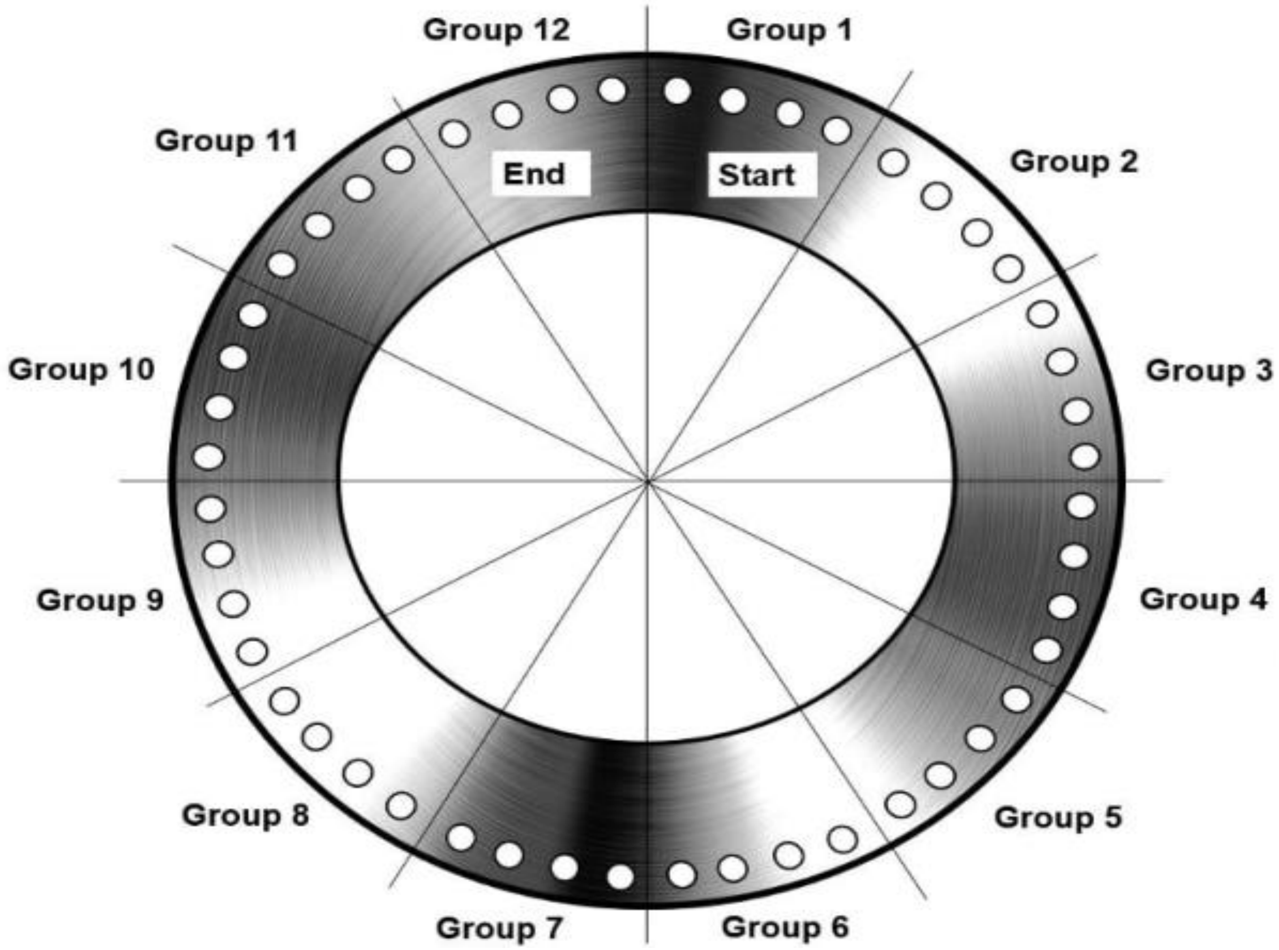


Fig 1 Legacy Numbering Pattern **Fig 2 Alternative to Legacy Numbering**

48-Bolt Flange Bolt Grouping



Group	Bolts
1	1-2-3-4
2	5-6-7-8
3	9-10-11-12
4	13-14-15-16
5	17-18-19-20
6	21-22-23-24
7	25-26-27-28
8	29-30-31-32
9	33-34-35-36-
10	37-38-39-40
11	41-42-43-44
12	45-46-47-48

Tightening Sequence for 12 Groups
1-7-4-10 2-8-5-11 3-9-6-12
The 12 group sequence is the same as a 12 bolt sequence.

In the case of very large flanges such as on 48-bolt flanges the process can be different. Here, groups of 4 adjacent bolts can be treated as '1 bolt', resulting in 12 groups. For example, tightening bolts 1,2,3,4 before moving onto group 7 – (Similar procedure to what you would do when tightening a 12-bolt flange). ASME advise that potential gasket damage or flange misalignment should be considered when bolts are grouped.

Alternative Assembly Patterns

There are other acceptable patterns which have been developed throughout years. Each has different advantages and care should be taken when selecting the right approach for your application. The right choice will depend upon the industry, gasket used and the manpower and equipment available to complete the job. Refer to ASME PCC-1 2019 for diagrams.

Alternative Assembly Pattern #1 Modified Legacy

Uses the same pattern as the legacy method but allows fewer passes and less overall effort. This is achieved because not every bolt goes through the different torque load amounts.

Alternative Assembly Pattern #2 Quadrant Pattern

Simpler to follow than the legacy pattern. This pattern follows a square quadrant sequence and is used on flanges with 16 bolts or more. The advantage of this is after 4 bolts are completed it is always the next loose bolt in any given quadrant that will always be the next to be tightened.

Alternative Assembly Pattern #3 Circular Pattern

Using this method, the same four bolts in a cross formation are tightened to bring the joint into alignment. Following this all bolts are tightened using a circular pattern.

Alternative Assembly Pattern #4 Simultaneous Multi-bolt Pattern (4 tools)

Allows 4 tools to be used, always maintaining even spacing around the flange. Brings parallel closure in less time than using a single tool in a cross pattern. Multi-bolt tightening works best on large flanges where hydraulic tools are connected to a common pressure source.

Alternative Assembly Pattern #5 Simultaneous Multi-bolt tightening with Circular Pattern (2 tools)

A pattern for use with 2 hydraulic tools simultaneously. Used in the chemical industry for thin flanges and soft gaskets.

Summary

To a novice, this all may seem more complex and overwhelming. But by following the correct procedures and taking the extra time will help avoid potentially dangerous and time-consuming maintenance in the future. Using a well-designed hydraulic torque wrench will make the process efficient and trouble free. These are available from Enerpac as square drive hydraulic torque wrenches and low-profile hydraulic torque wrenches.

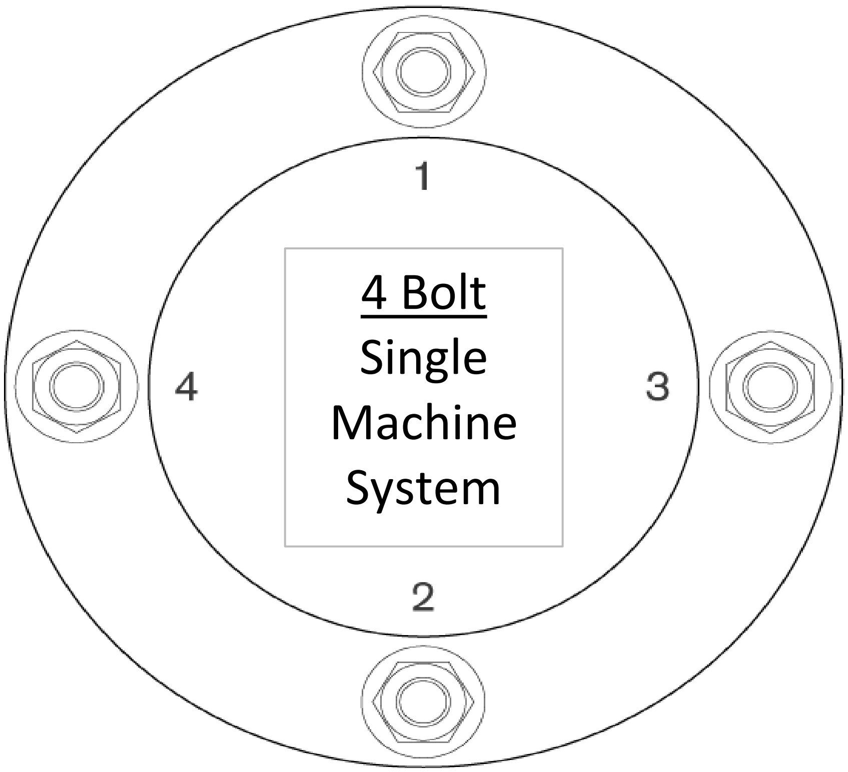
Disclaimer

This article is intended to provide a basic overview only. Please refer ASME PCC-1 2019 to determine the correct procedure for your particular application.

It is important to note that the bolting sequence is just one of the many important things to get right to ensure joint integrity. There are many other factors to consider such as gasket selection, bolt lubrication, bolt selection, and the condition of the flange sealing surface.

Be aware that flanges can be damaged during transport and installation, but these can be machined on-site to ASME specifications using a flange facing machine.

4 BOLT



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COMPANY:________________________

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JOB LOCATION:_____________________

JOB NUMBER:______________________

FLANGE IDENTIFIER:_________________

STUD GRADE:______________________

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PERCENT YIELD:____________________

BOLT STRESS:______________________

AREA STRESS:______________________

BOLT LOAD:________________________

LUBRICANT:________________________

K-FACTOR:_________________________

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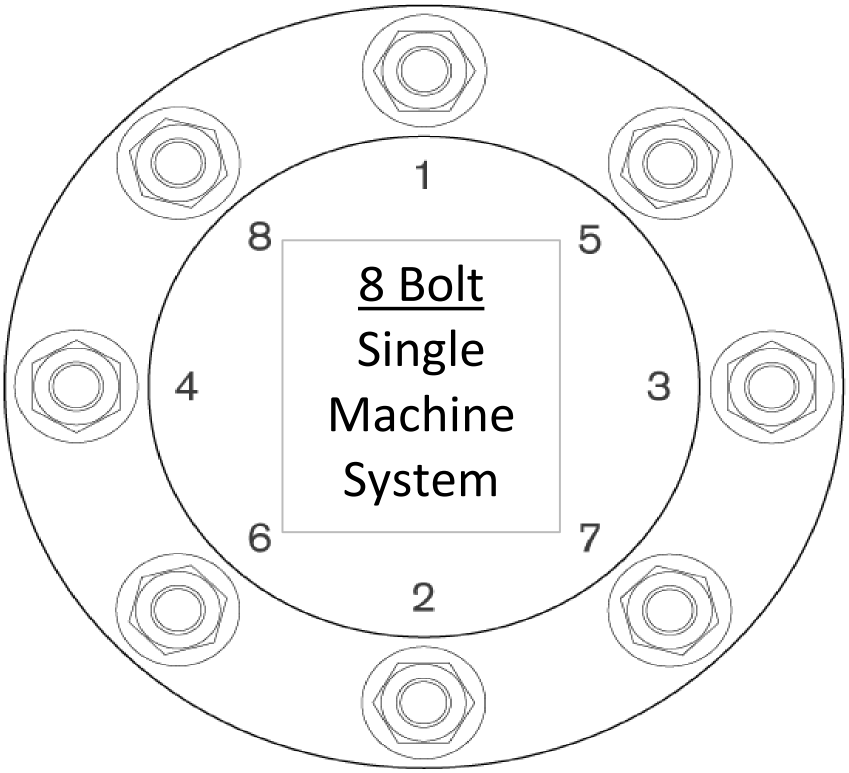
8 BOLT



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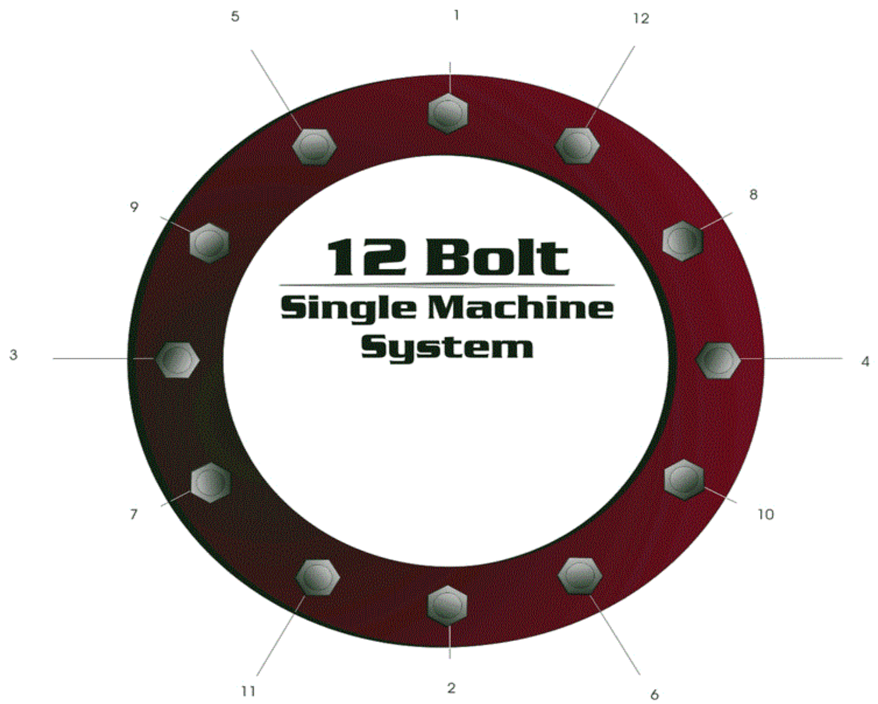
12 BOLT



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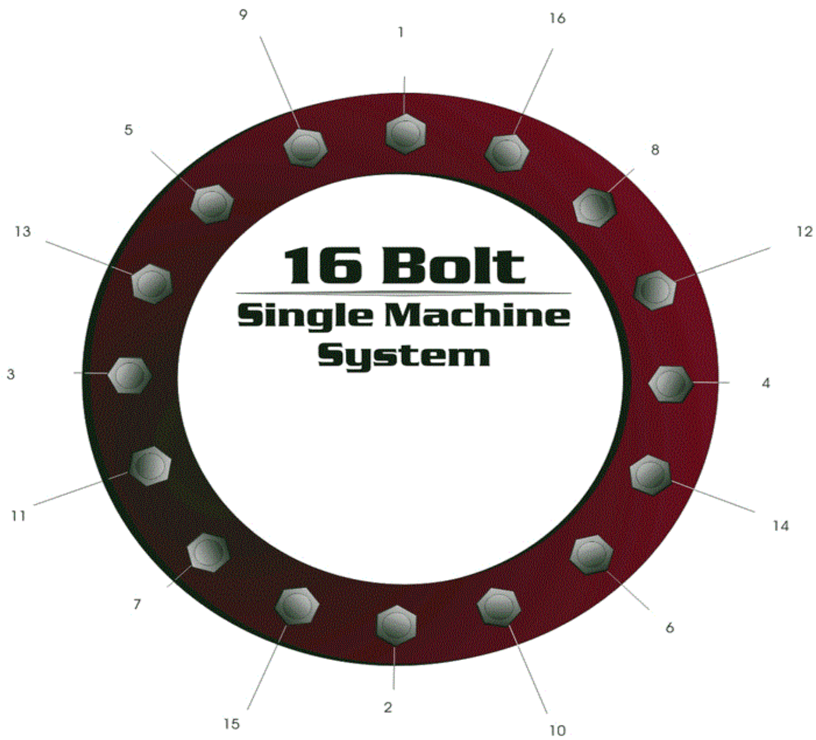
16 BOLT



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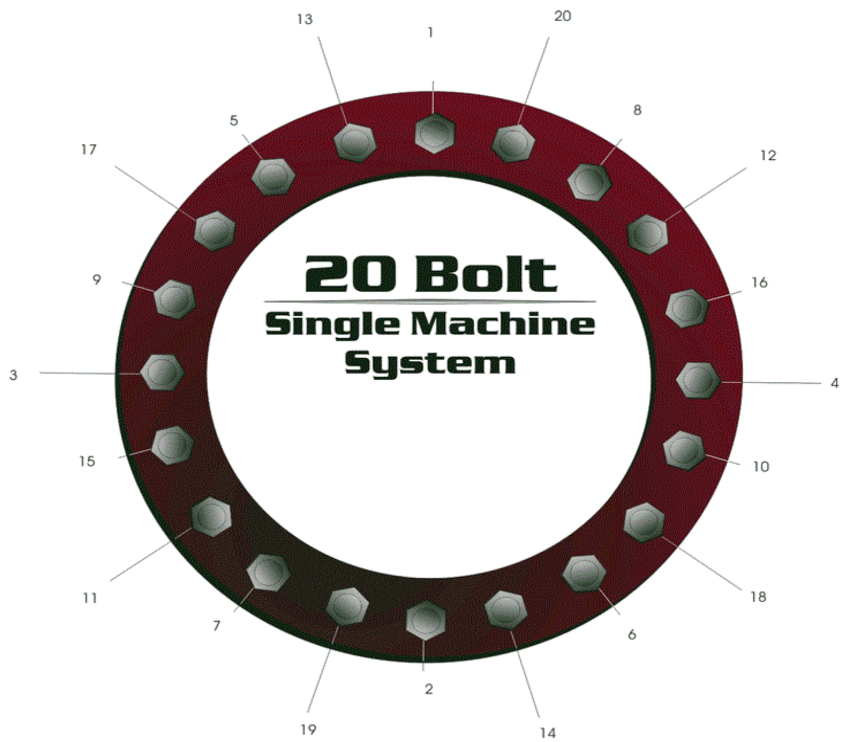
20 BOLT



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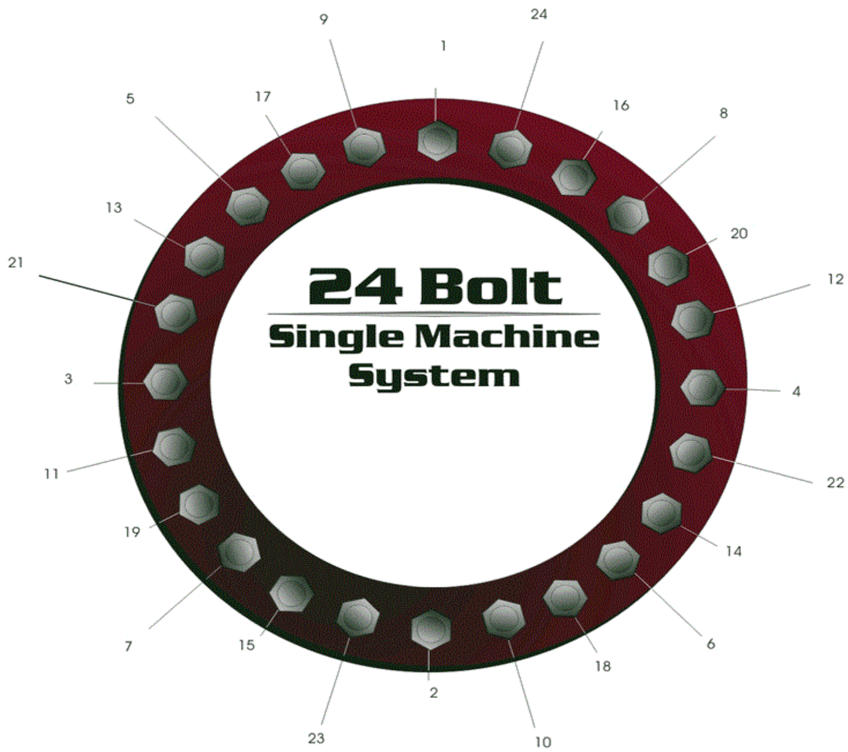
HYTORC/Contractor QA/QC

24 BOLT



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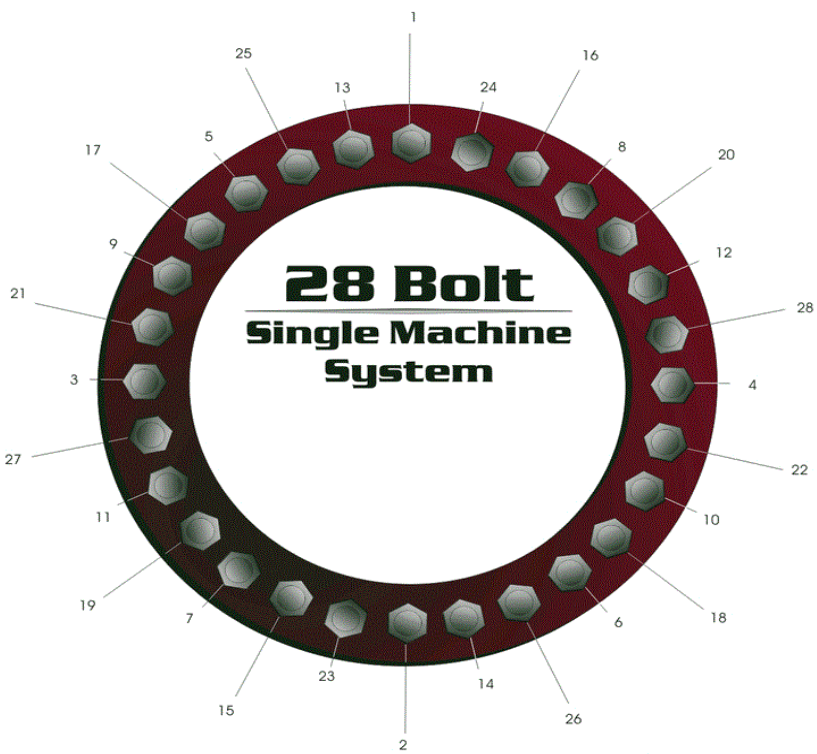
28 BOLT



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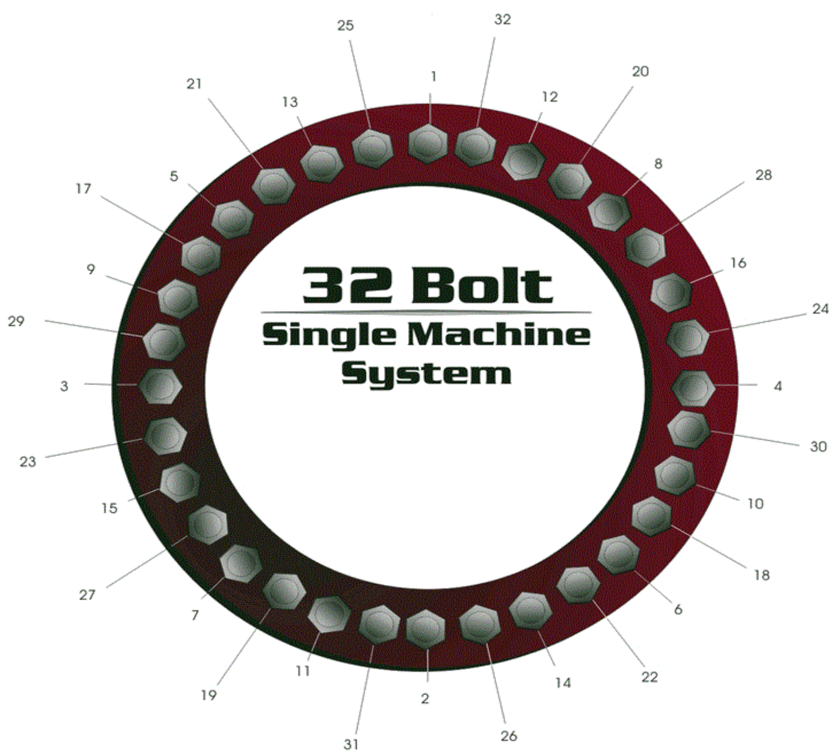
32 BOLT



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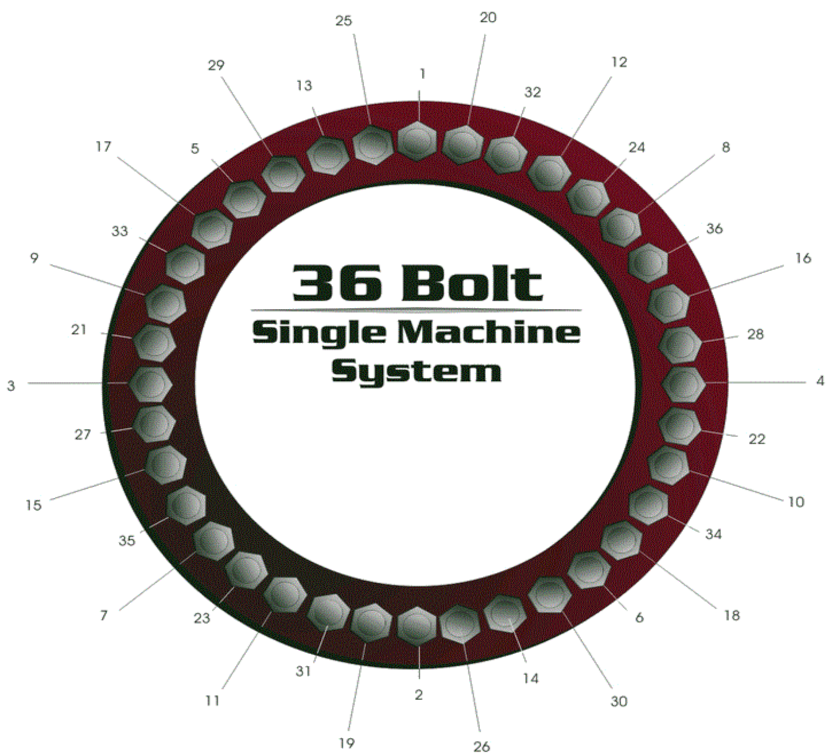
36 BOLT



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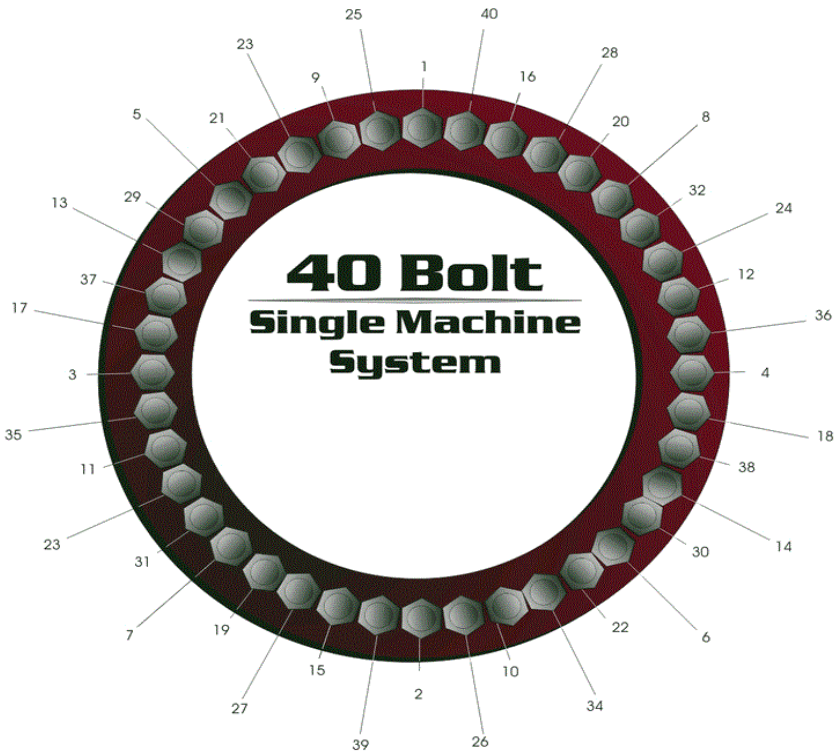
40 BOLT



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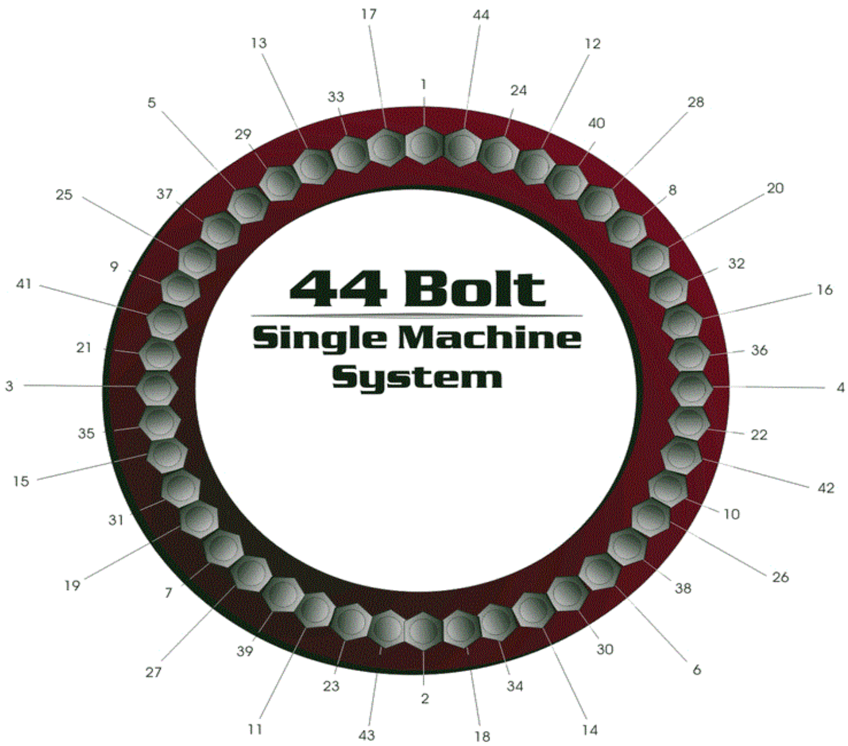
HYTORC/Contractor **QA/QC**

44 BOLT



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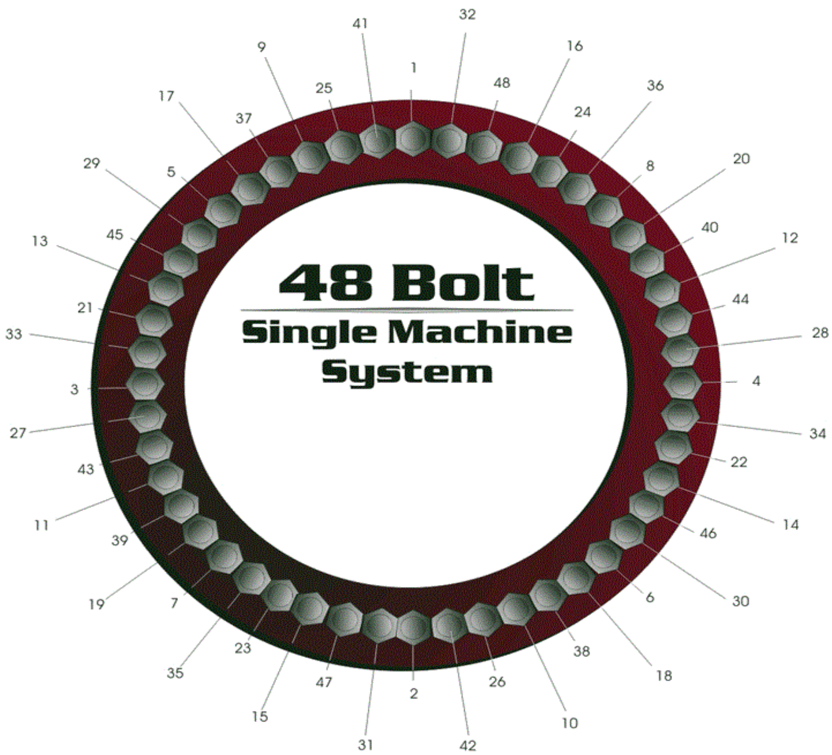
48 BOLT



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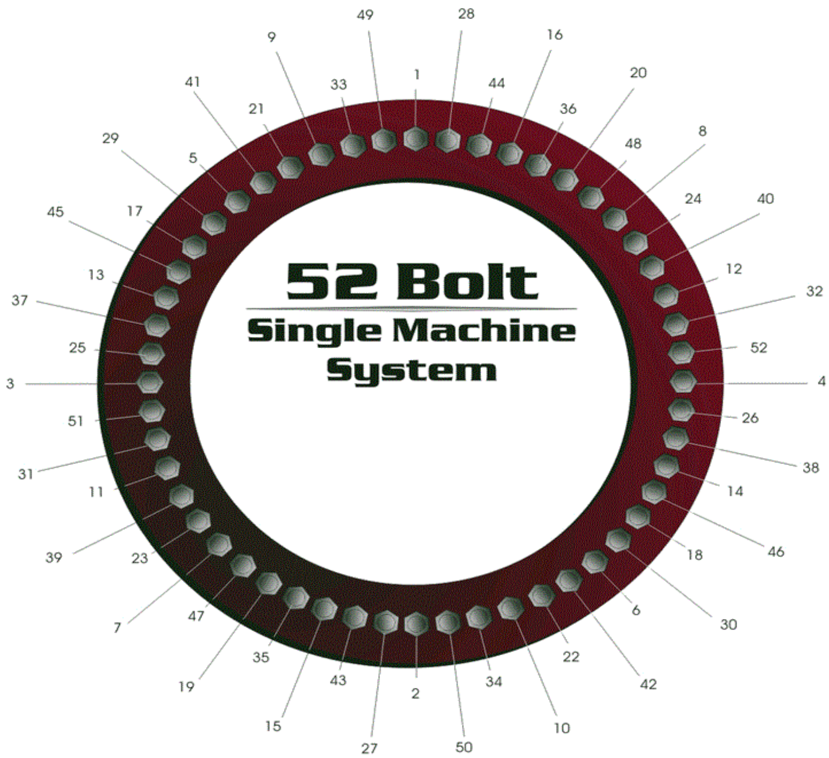
52 BOLT



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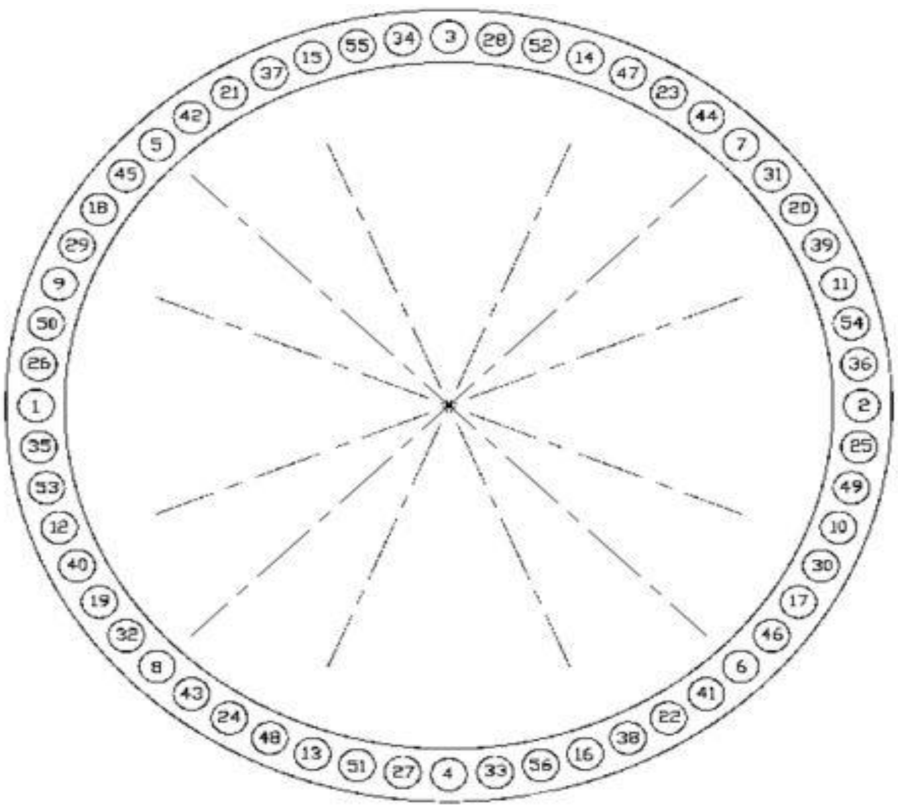
HYTORC®

56 BOLT



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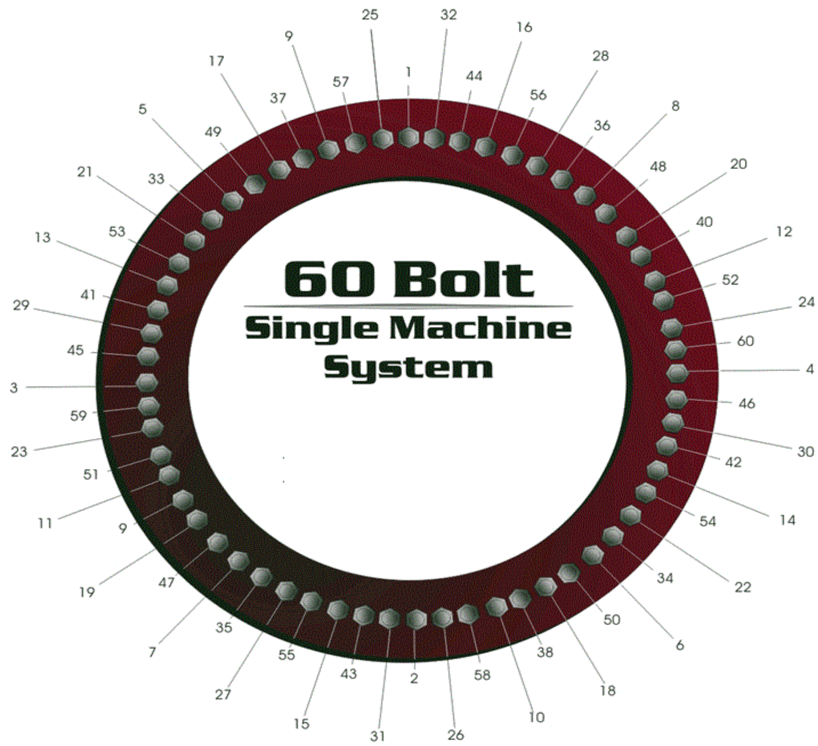
60 BOLT



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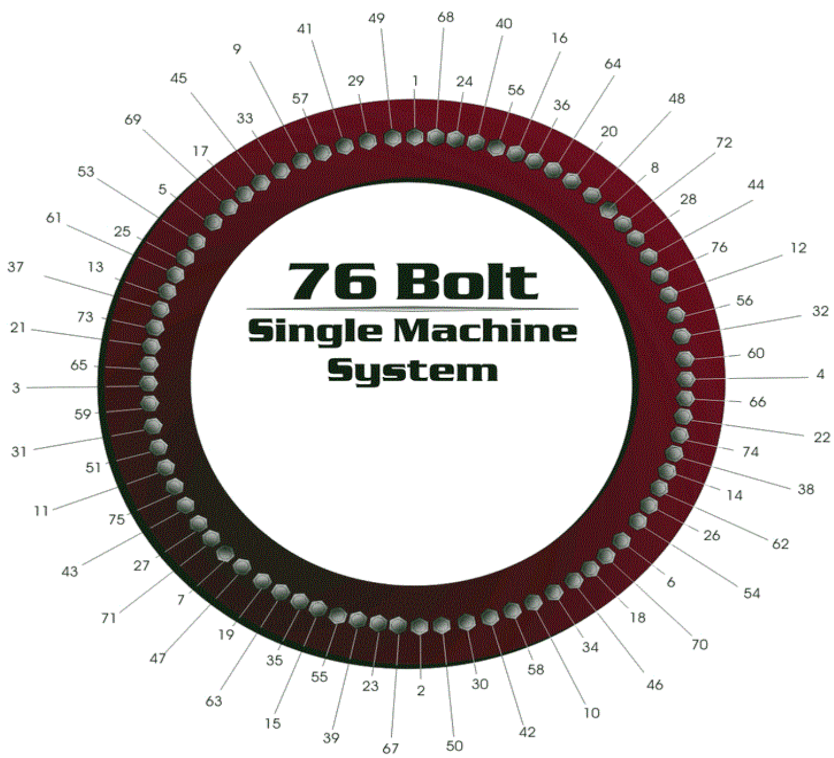
76 BOLT



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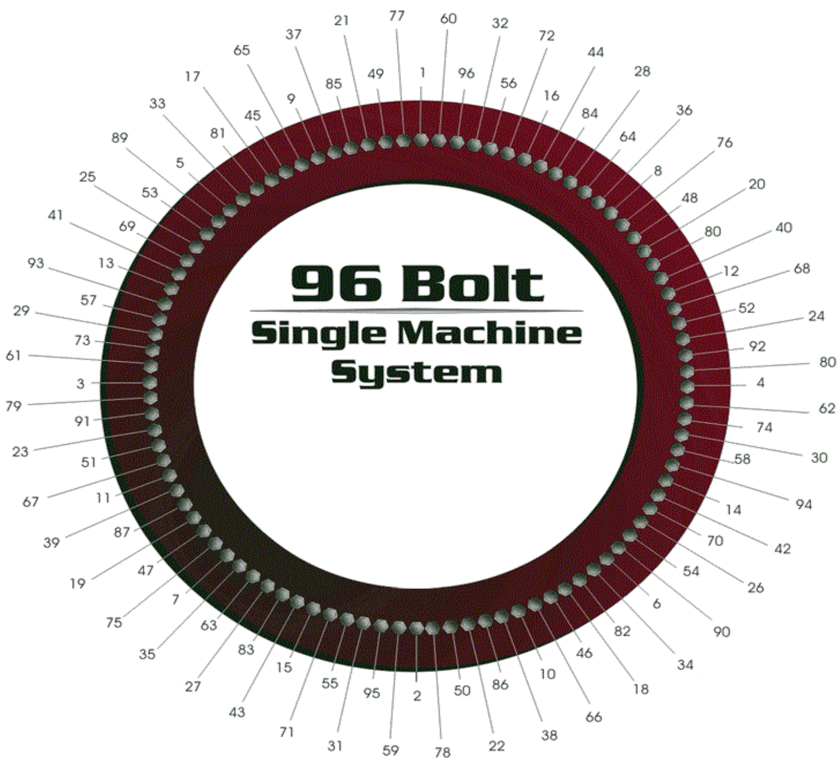
96 BOLT



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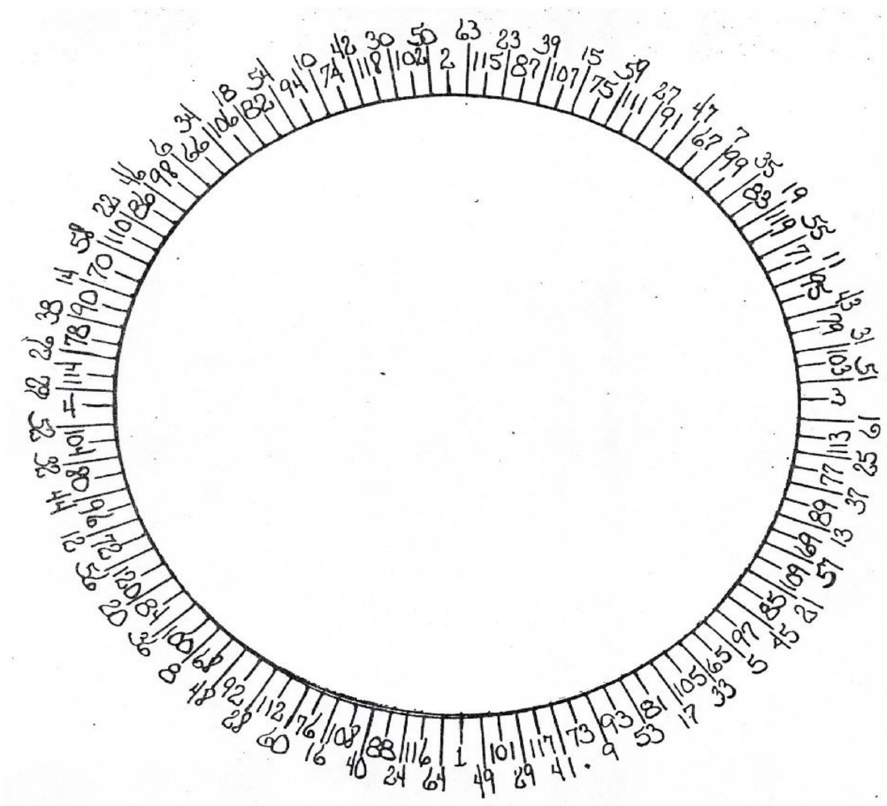
120 BOLT



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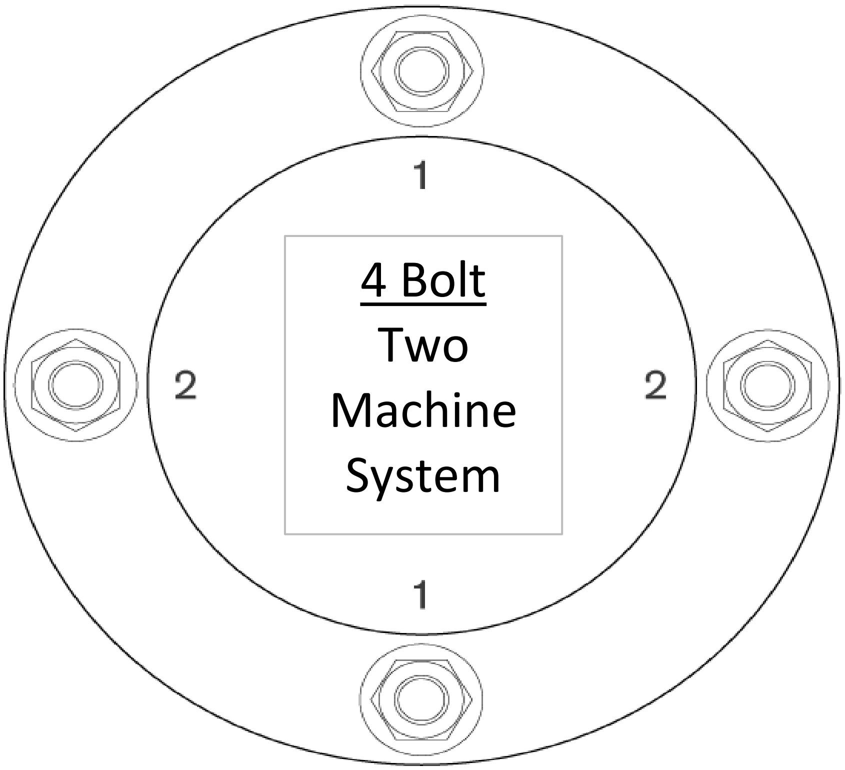
HYTORC/Contractor QA/QC

4 BOLT



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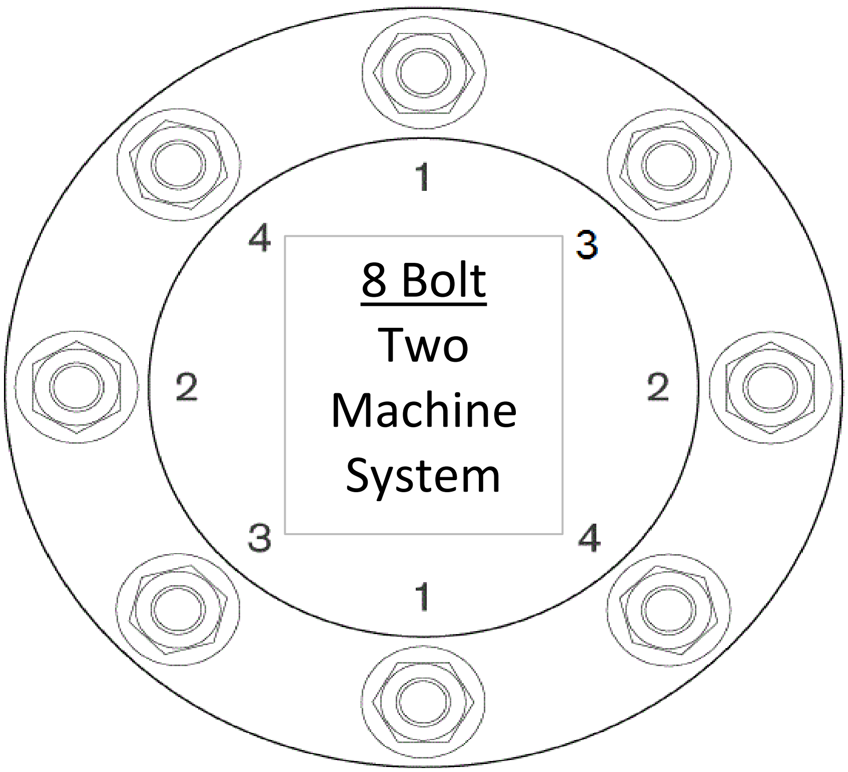
QA/QC

8 BOLT



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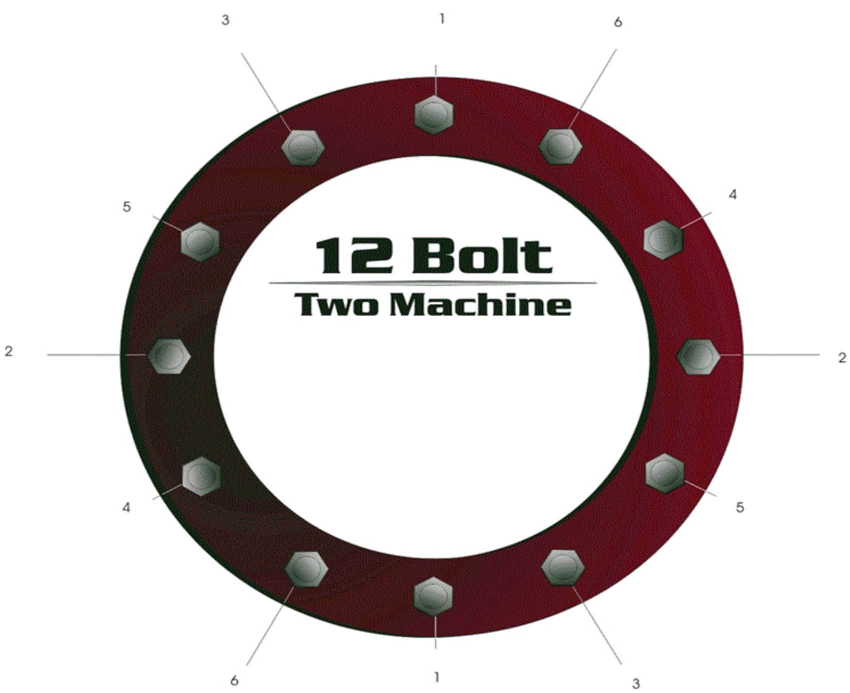
HYTORC®

12 BOLT



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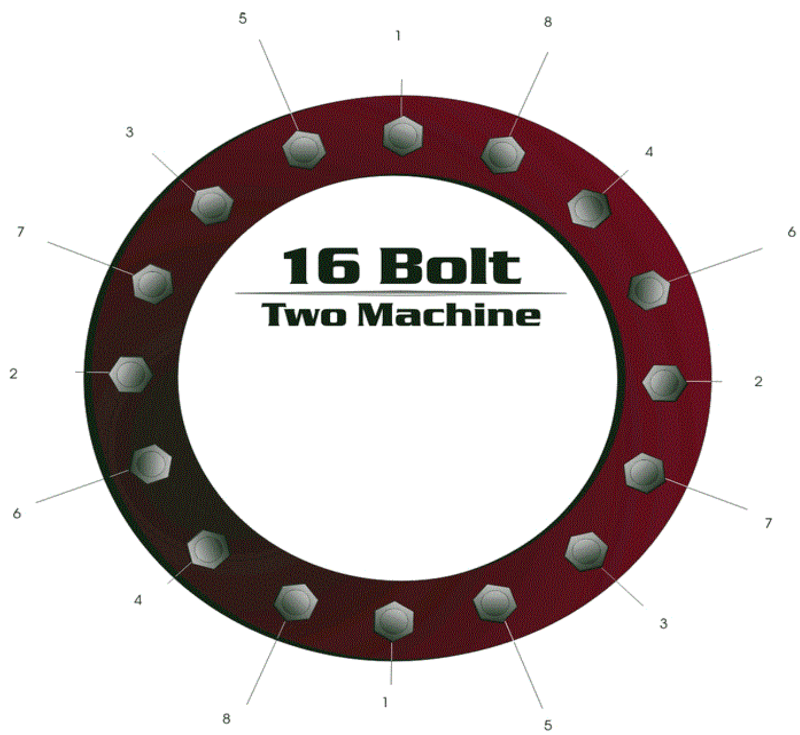
HYTORC®

16 BOLT



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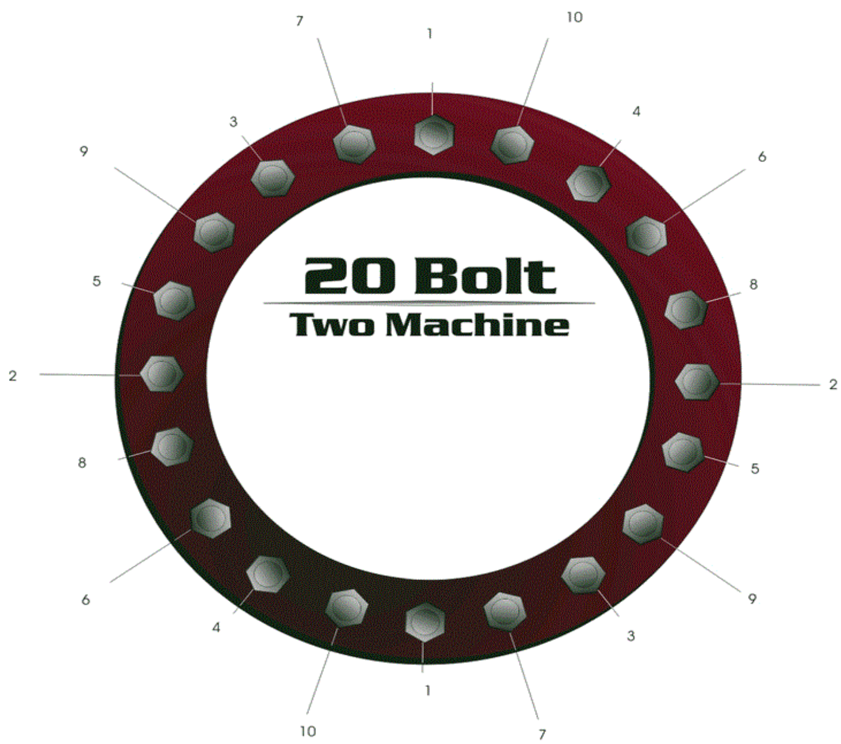
HYTORC/Contractor **QA/QC**

HYTORC®

20 BOLT



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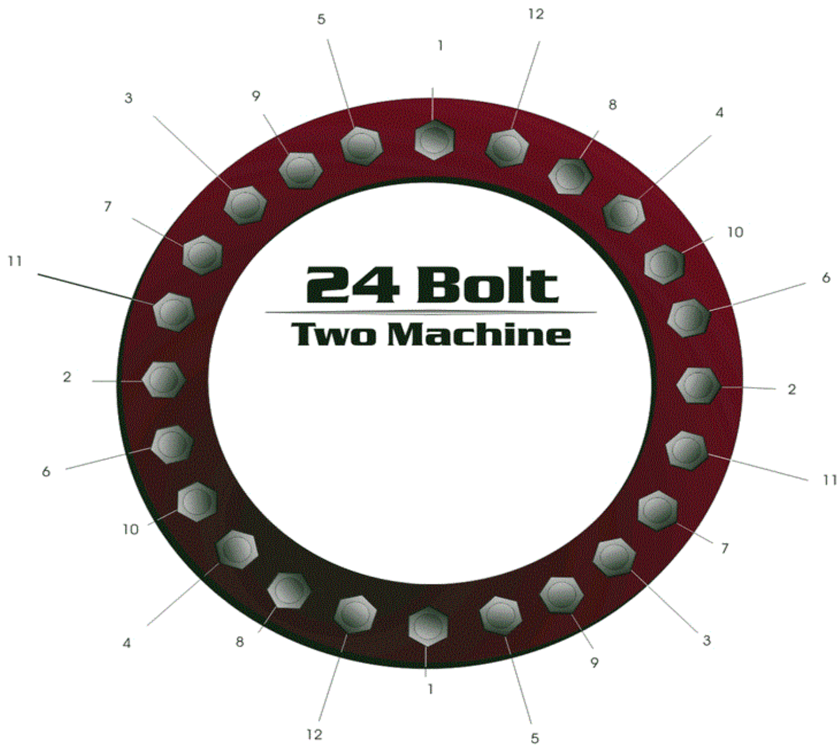
HYTORC®

24 BOLT



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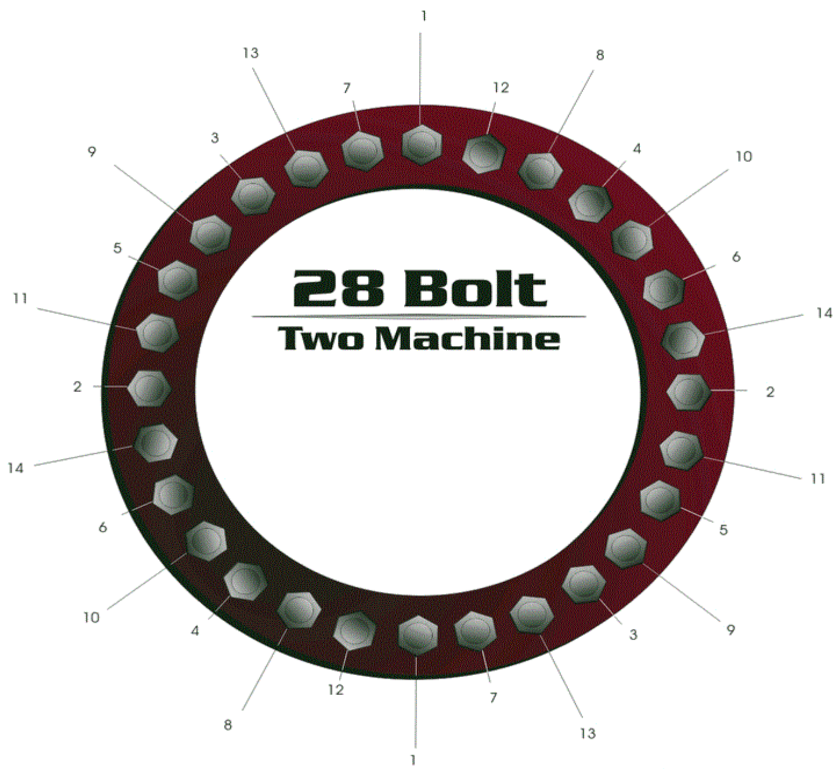
28 BOLT



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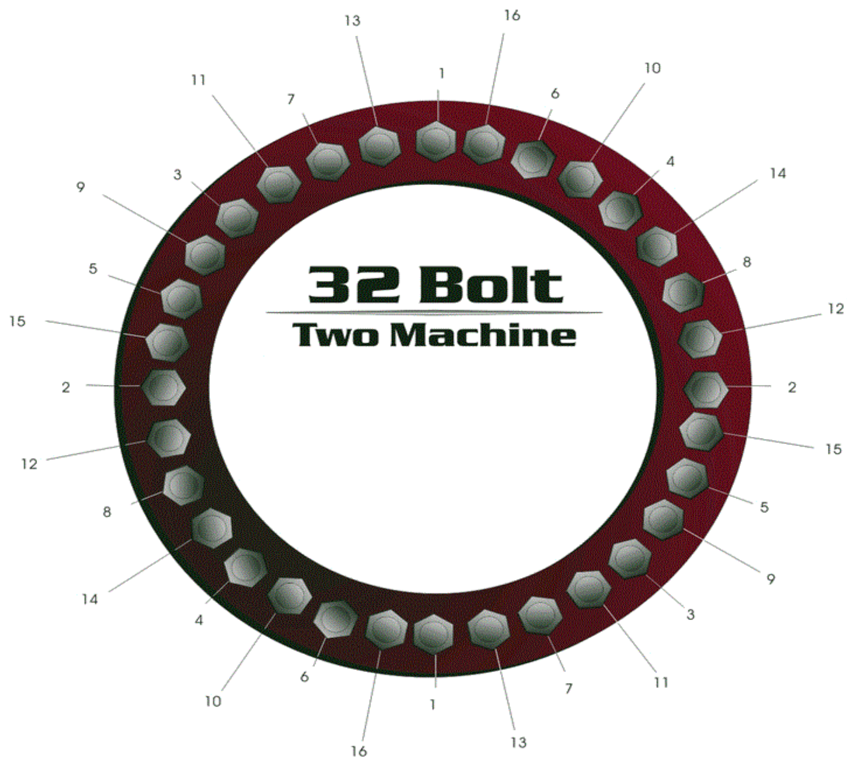
32 BOLT



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HYTORC/Contractor QA/QC

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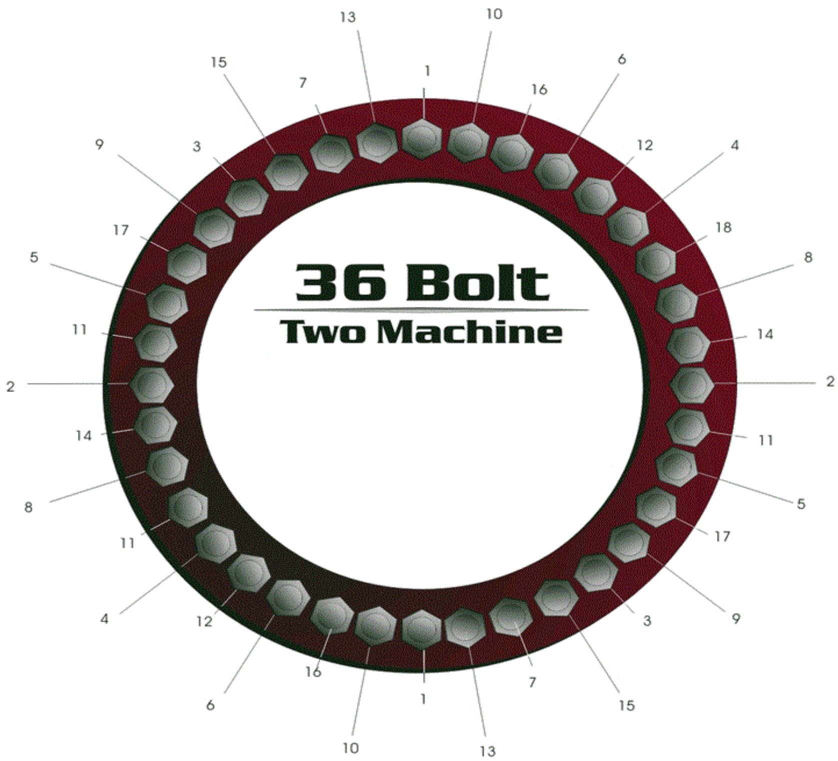
36 BOLT



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HYTORC/Contractor QA/QC

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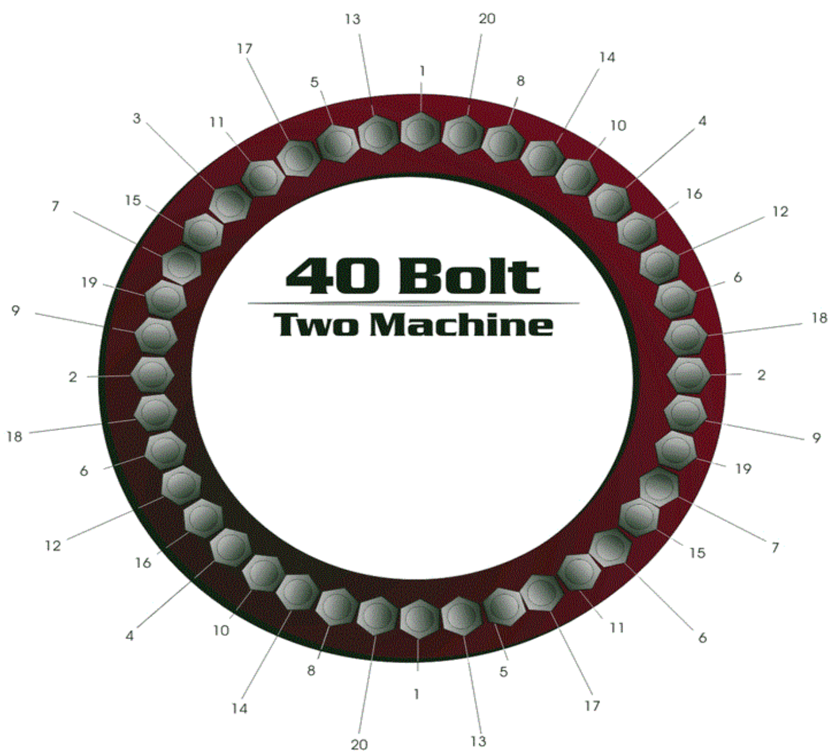
40 BOLT



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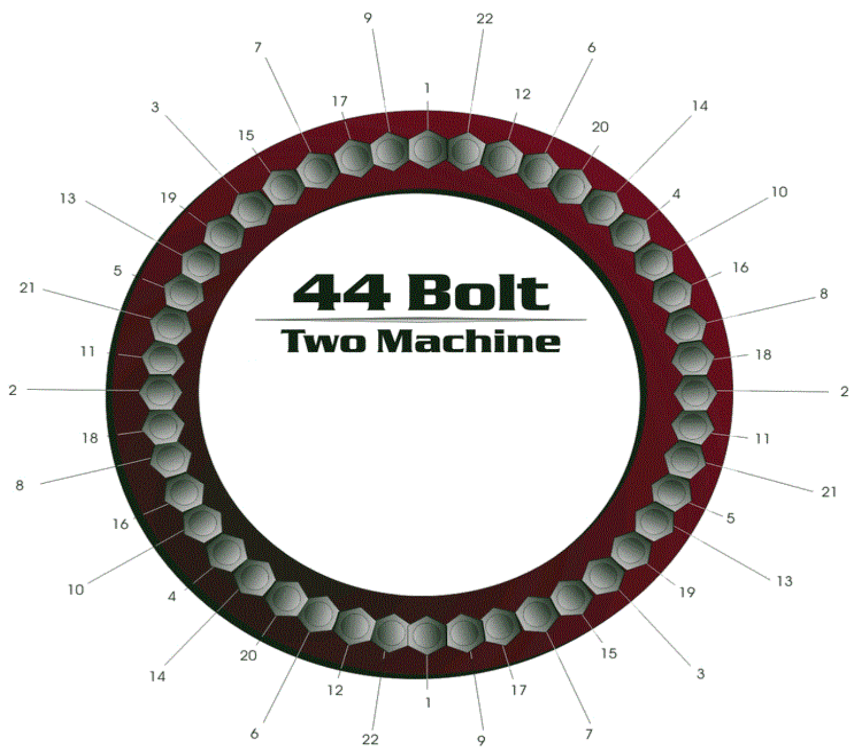
44 BOLT



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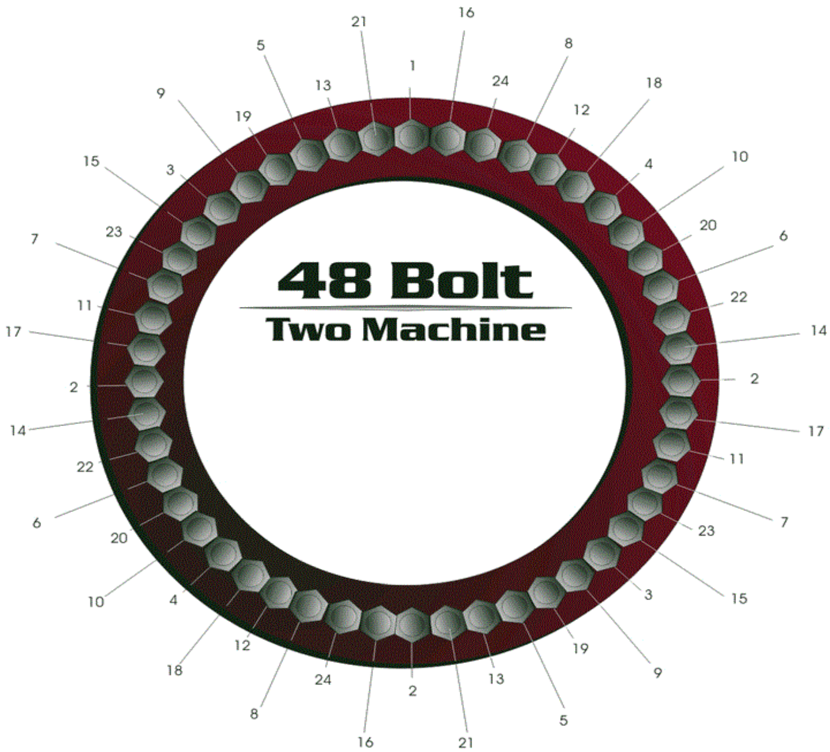
48 BOLT



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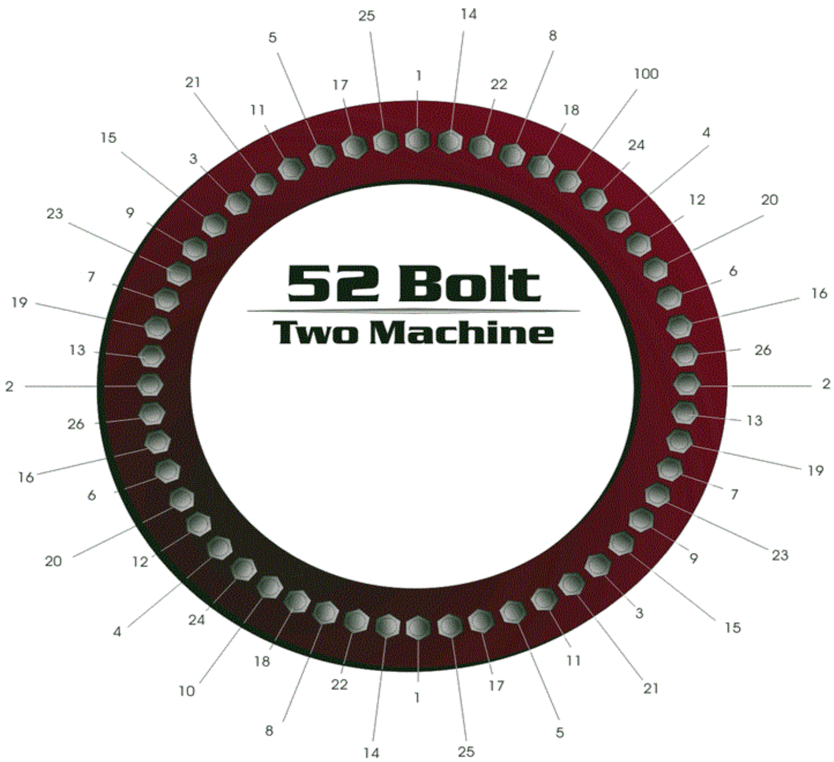
52 BOLT



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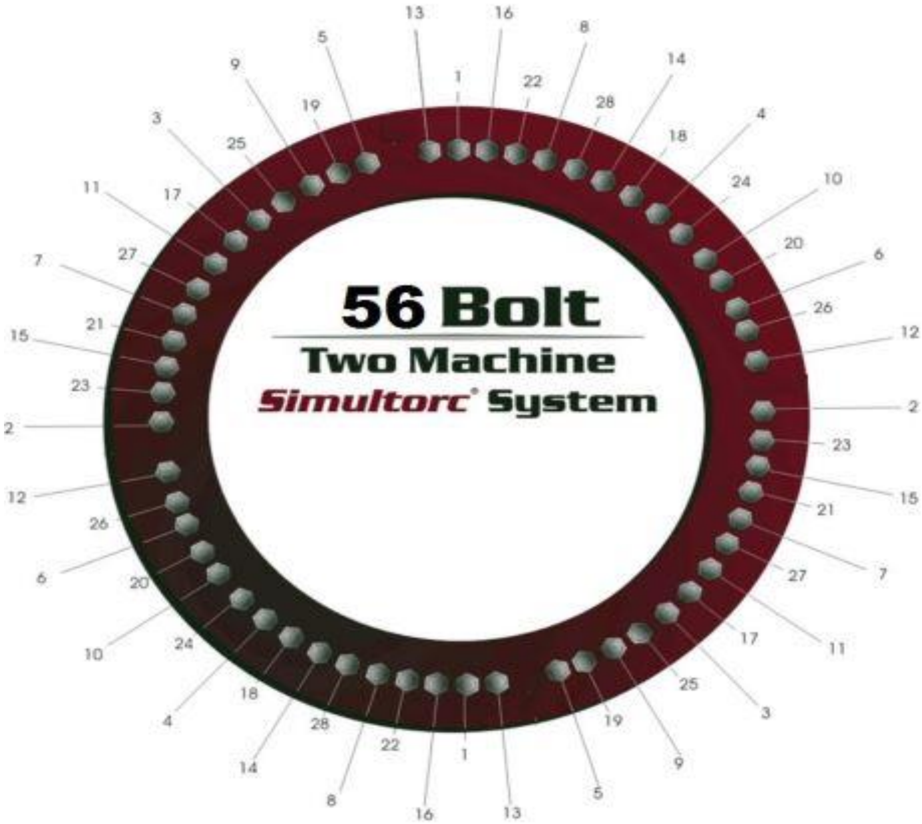
56 BOLT



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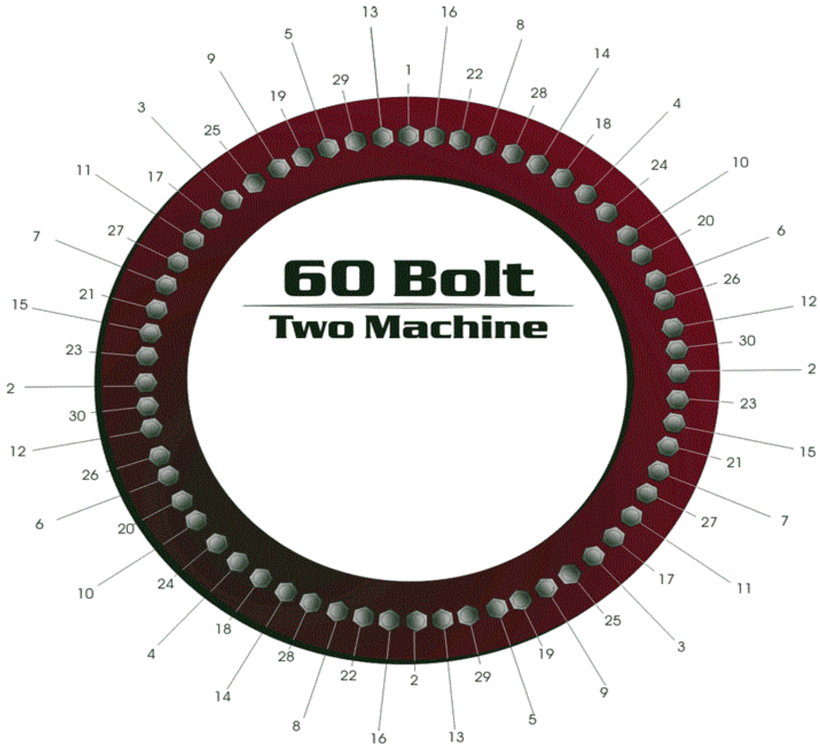

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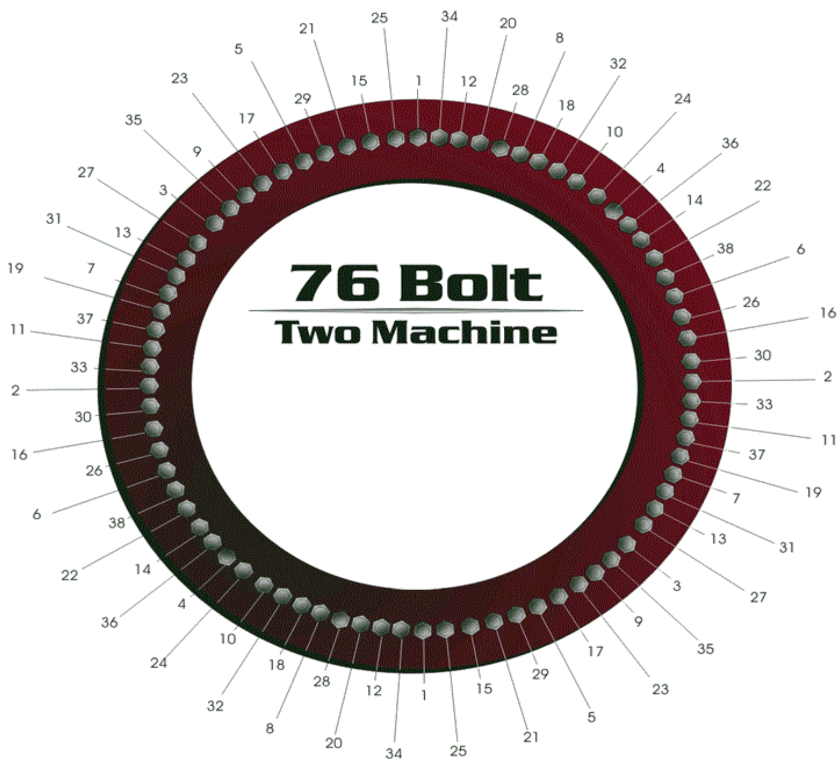
76 BOLT



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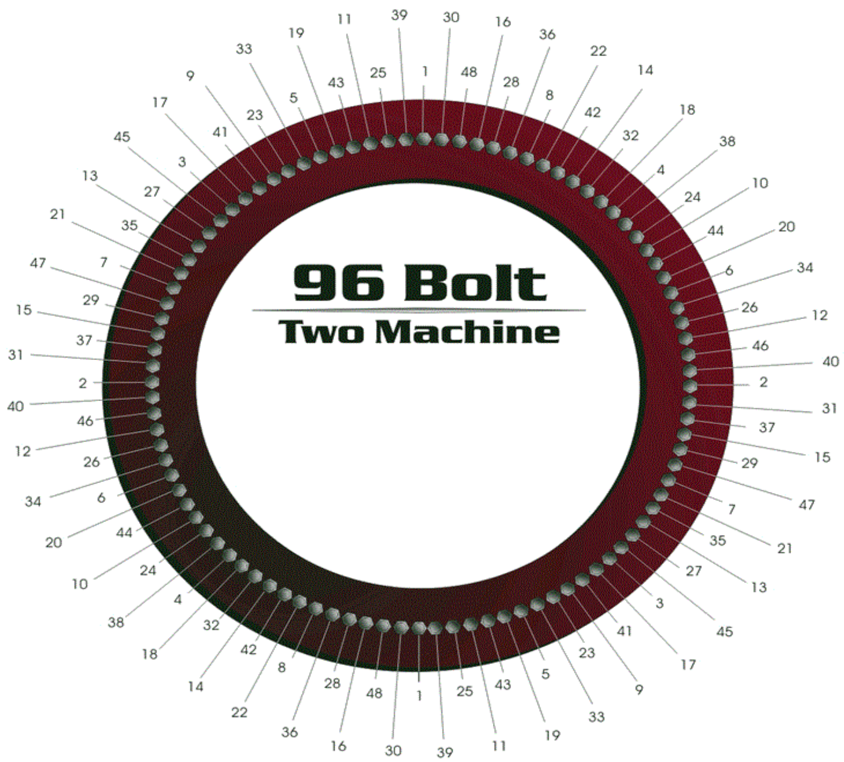
96 BOLT



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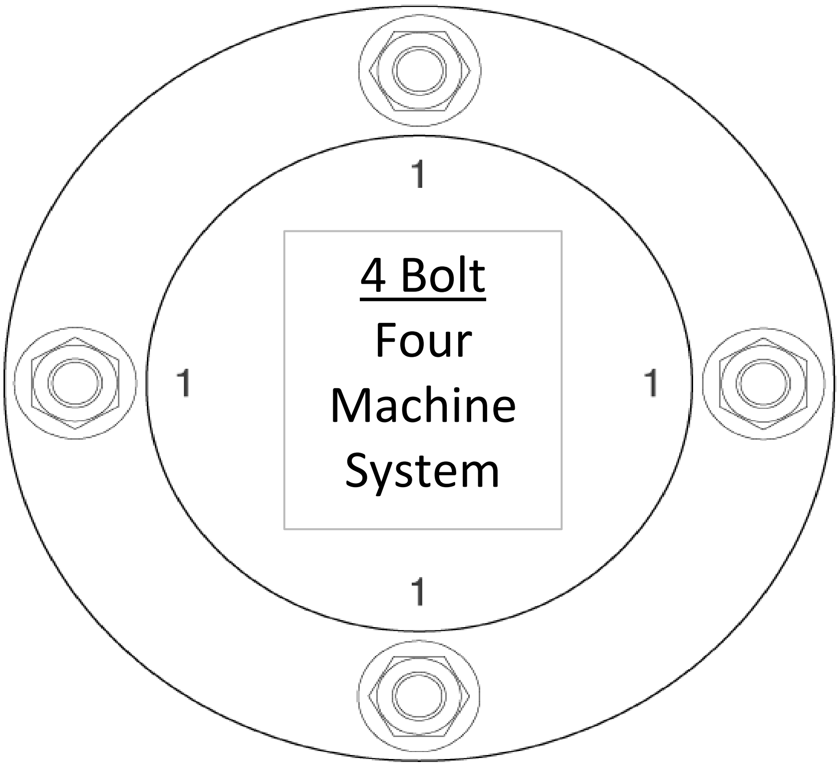

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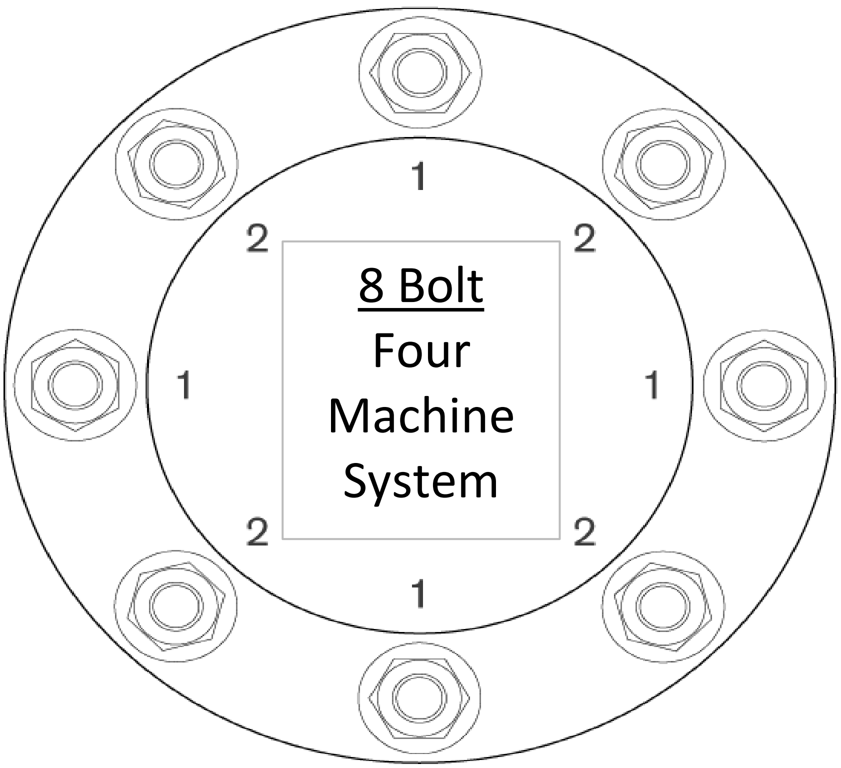

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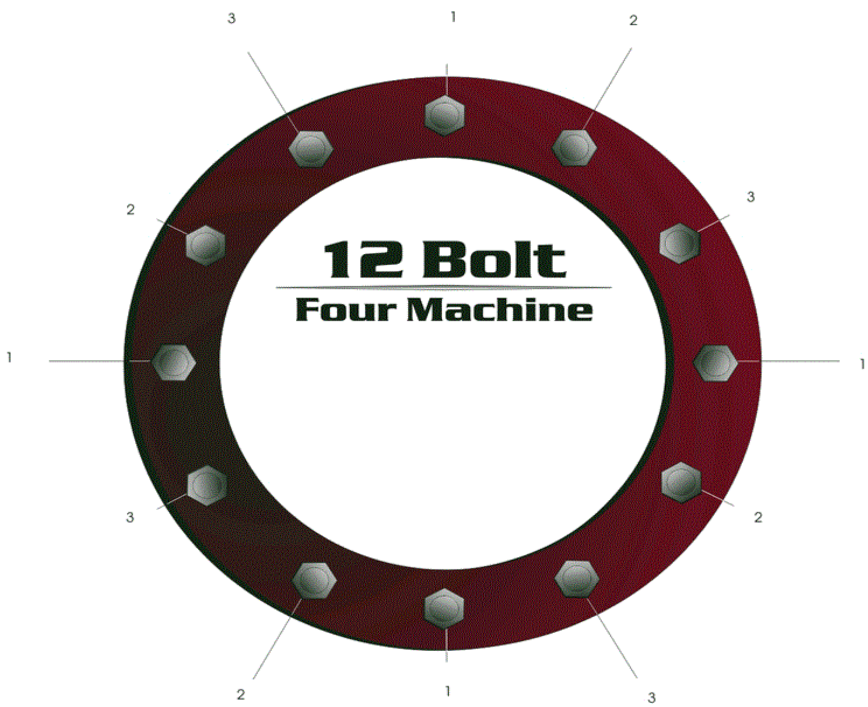

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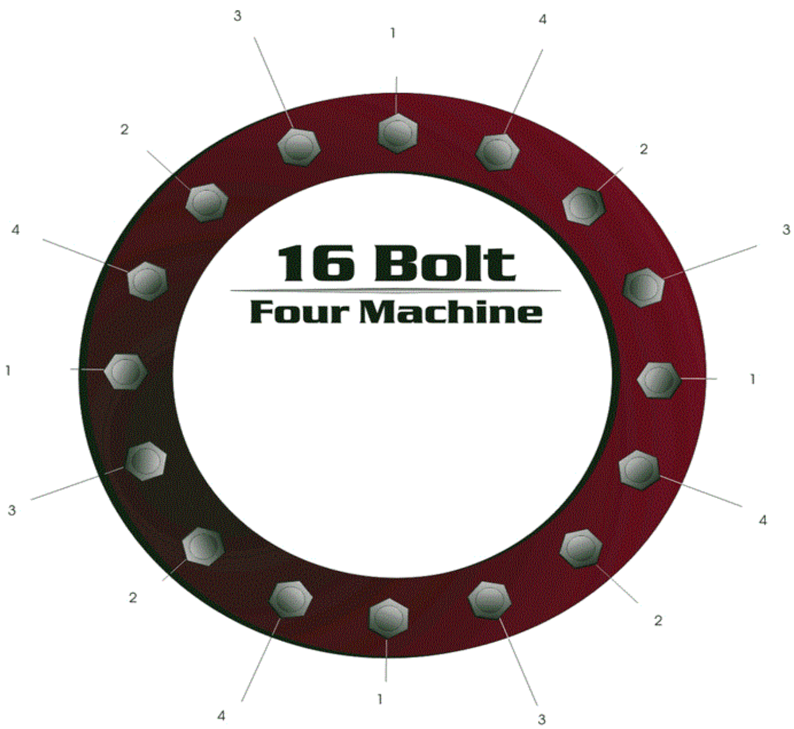

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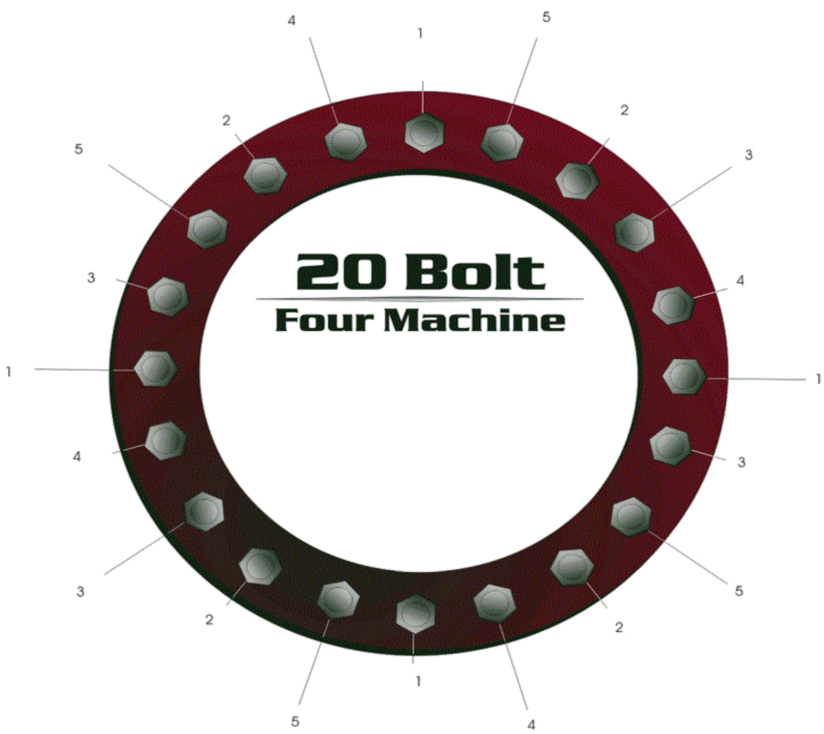
HYTORC®

20 BOLT



DATE:_______/_______/____________

COMPANY:________________________

TECHNICIAN:______________________

JOB LOCATION:____________________

JOB NUMBER:_____________________

FLANGE IDENTIFIER:________________

STUD GRADE:_____________________

STUD DIAMETER:__________________

PERCENT YIELD:___________________

BOLT STRESS:____________________

AREA STRESS:____________________

BOLT LOAD:_______________________

LUBRICANT:_______________________

K-FACTOR:________________________

TOOL USED:_______________________

FINAL TORQUE:____________________

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PASS 3 TORQUE:____________________ PUMP PSI:______________

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PASS 5 TORQUE:____________________ PUMP PSI:______________

PASS 6 TORQUE:____________________ PUMP PSI:______________

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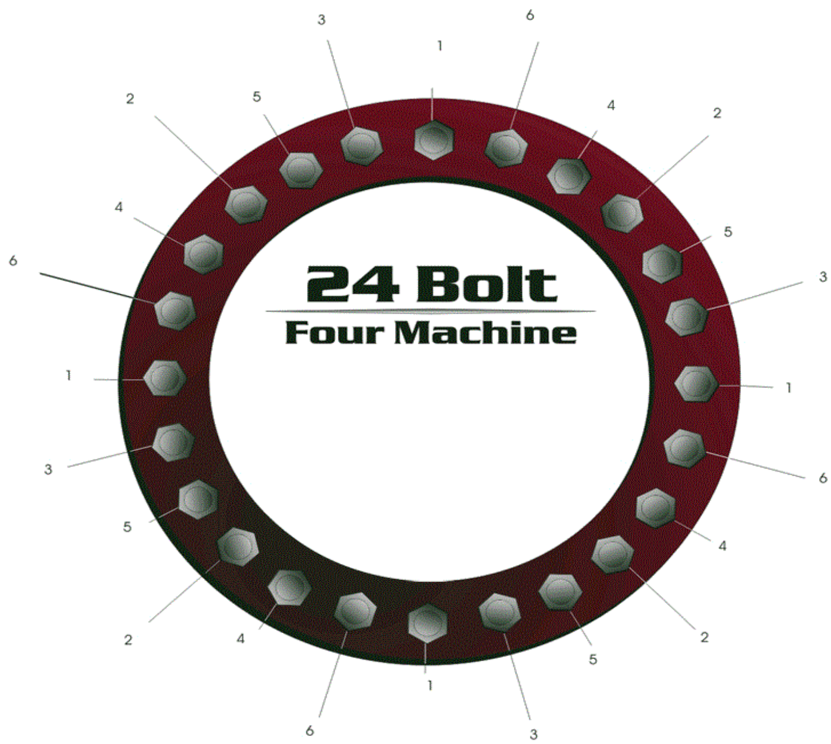
HYTORC/Contractor QA/QC

24 BOLT



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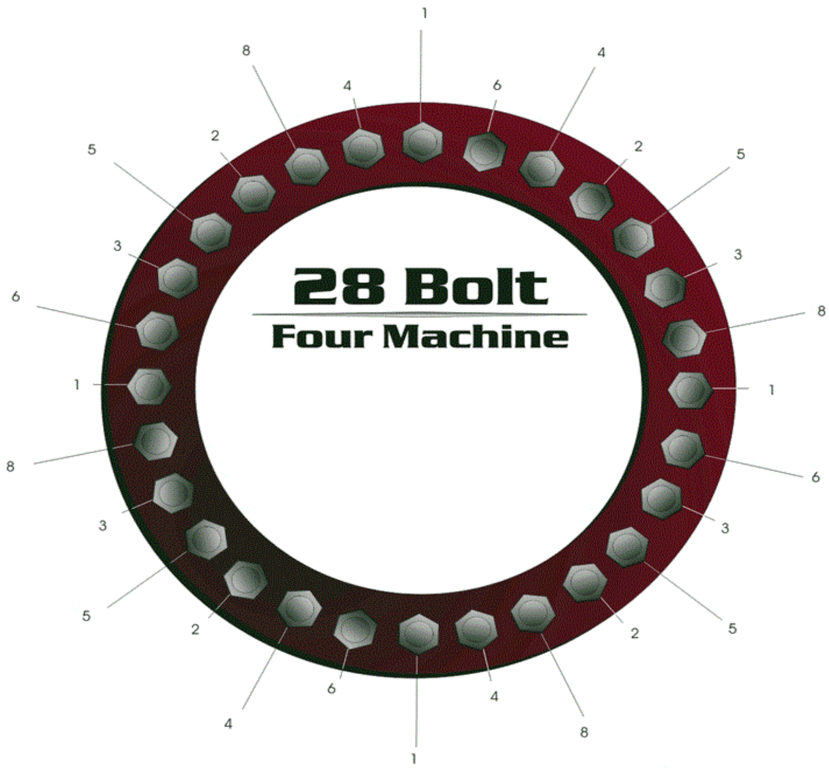
HYTORC/Contractor

Signature:____________________________________
QA/QC

28 BOLT



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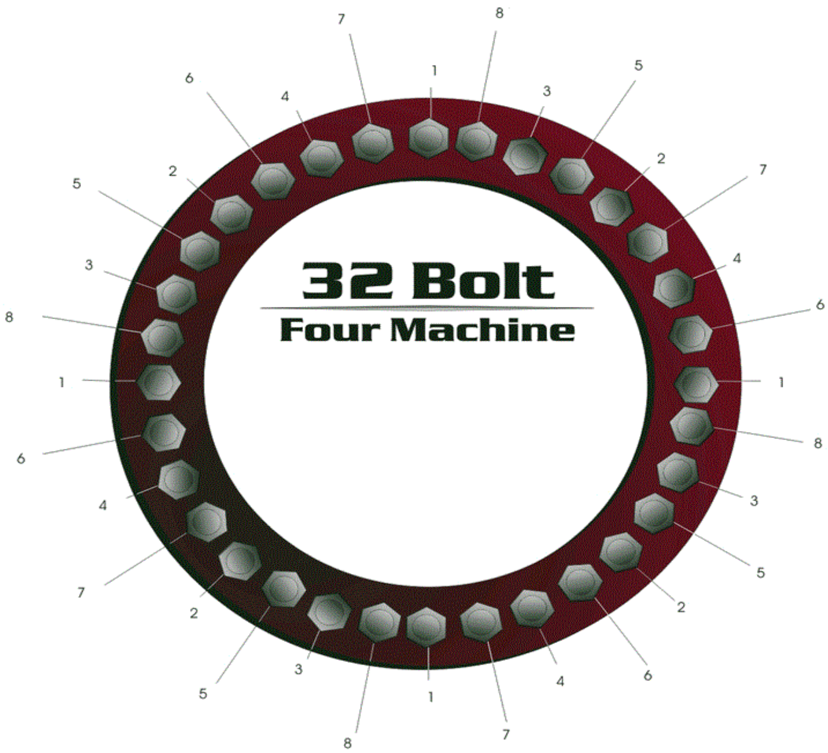
PASS 6 TORQUE:____________________ PUMP PSI:______________

Signature:____________________________________
HYTORC/Contractor

Signature:____________________________________
QA/QC

32 BOLT



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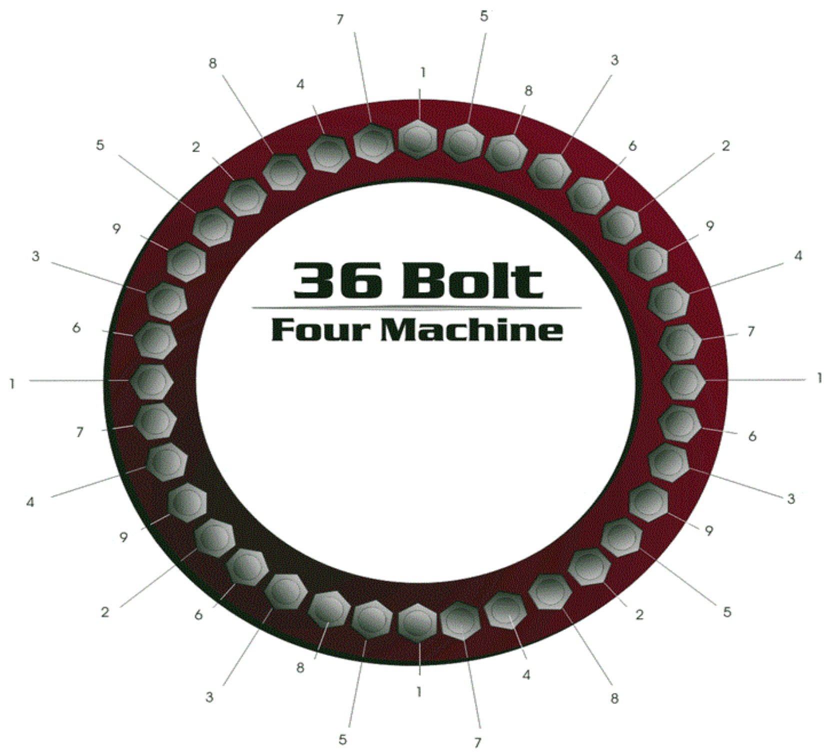
PASS 6 TORQUE:____________________ PUMP PSI:______________

Signature:___________________________________ Signature:____

HYTORC/Contractor QA/QC

HYTORC®

36 BOLT



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FLANGE IDENTIFIER:________________

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K-FACTOR:_________________________

TOOL USED:________________________

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PASS 6 TORQUE:____________________ PUMP PSI:______________

Signature:____________________________________

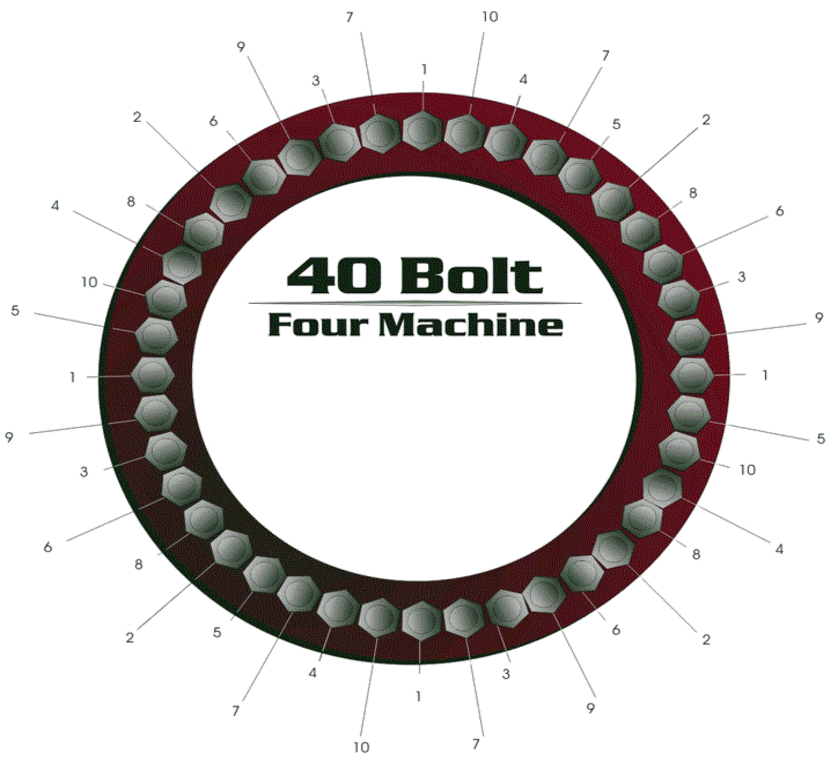
HYTORC/Contractor

Signature:____________________________________

QA/QC

HYTORC®

40 BOLT



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JOB LOCATION:_______________________

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BOLT LOAD:__________________________

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PASS 6 TORQUE:_______________________ PUMP PSI:________________

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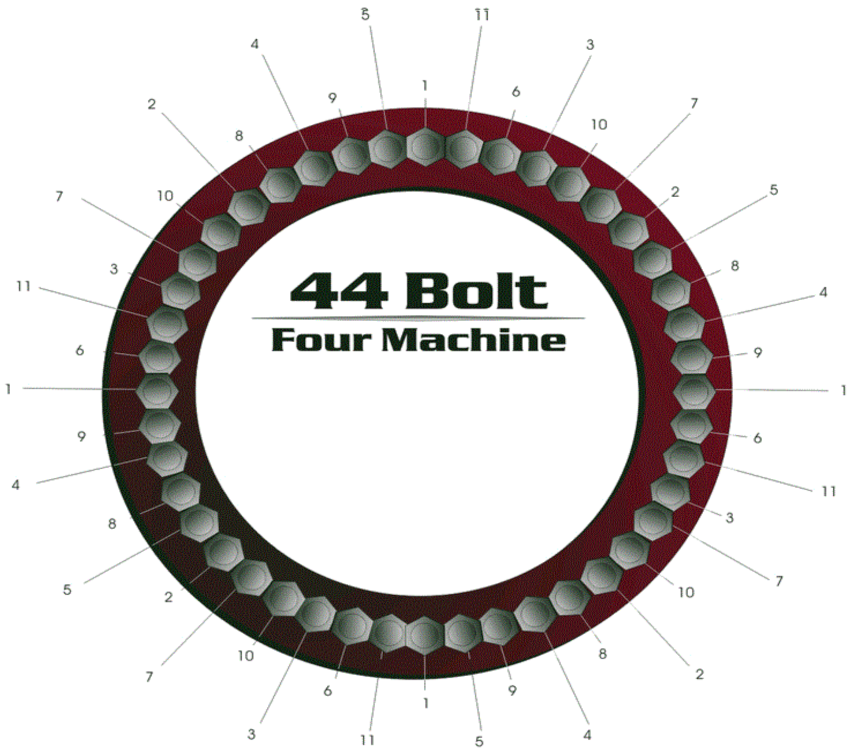
HYTORC/Contractor QA/QC

HYTORC®

44 BOLT



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TECHNICIAN:__________________________

JOB LOCATION:________________________

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BOLT LOAD:____________________________

LUBRICANT:____________________________

K-FACTOR:_____________________________

TOOL USED:____________________________

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PASS 5 TORQUE:_______________________ **PUMP PSI:**________________

PASS 6 TORQUE:_______________________ **PUMP PSI:**________________

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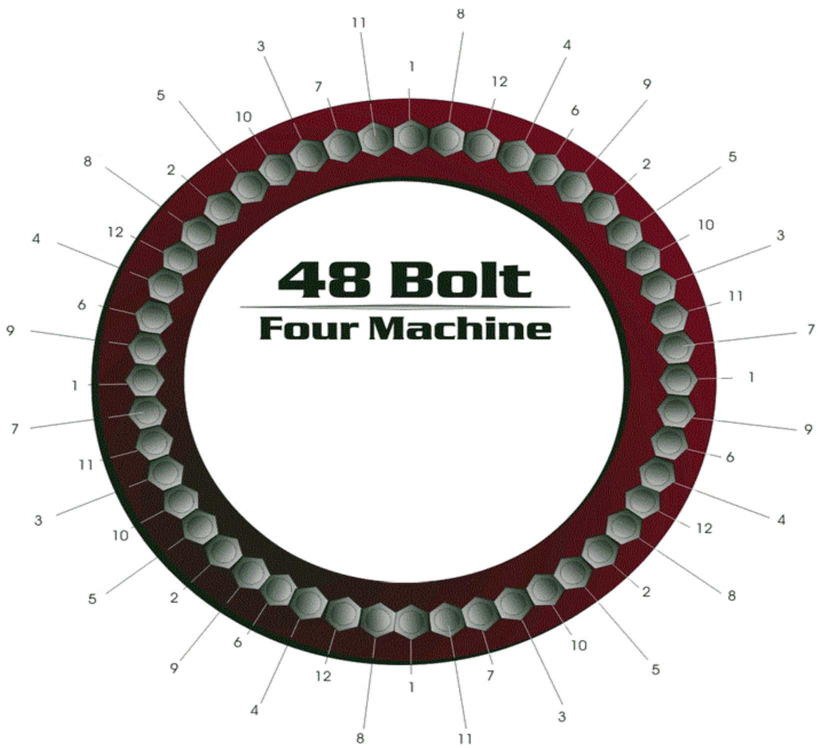
HYTORC/Contractor **QA/QC**

HYTORC®

48 BOLT



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STUD GRADE:_____________________

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PASS 5 TORQUE:____________________ PUMP PSI:______________

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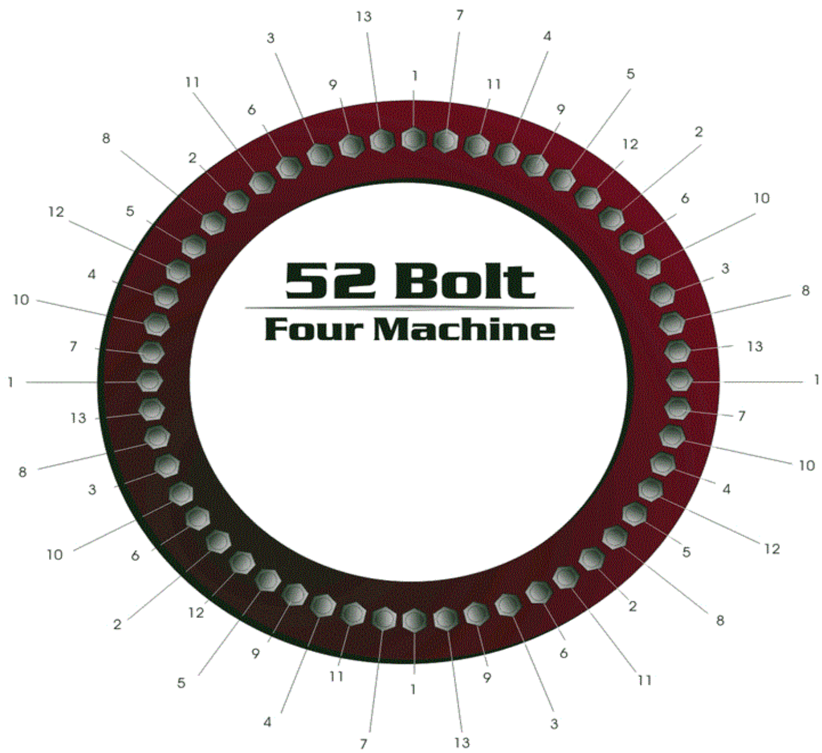
Signature:_________________________________ Signature:____________________________________

HYTORC/Contractor QA/QC

HYTORC®

52 BOLT



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COMPANY:_______________________

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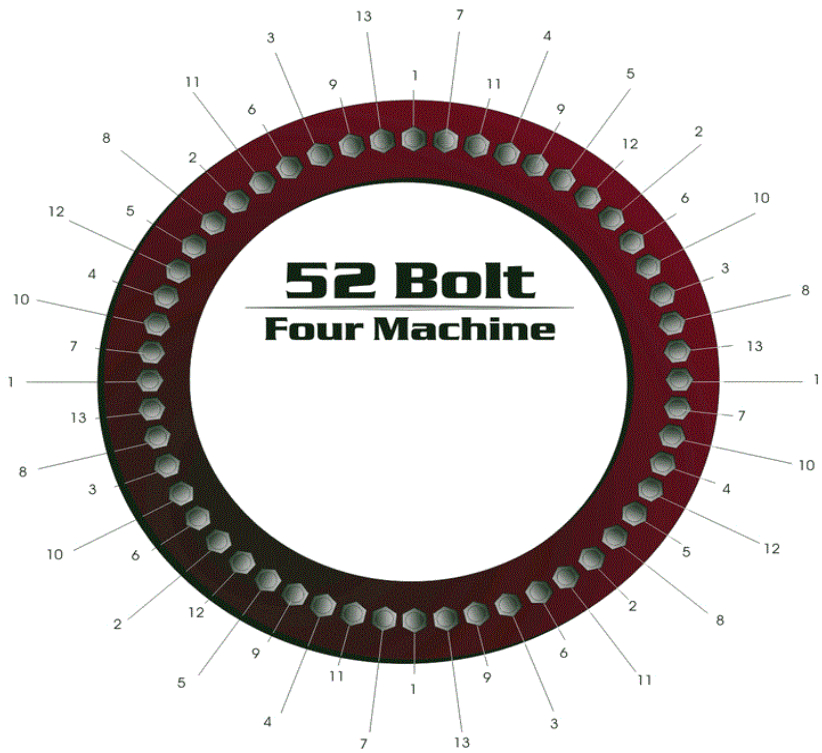
Signature:__________________________________
HYTORC/Contractor

Signature:____________________________________
QA/QC

52 BOLT



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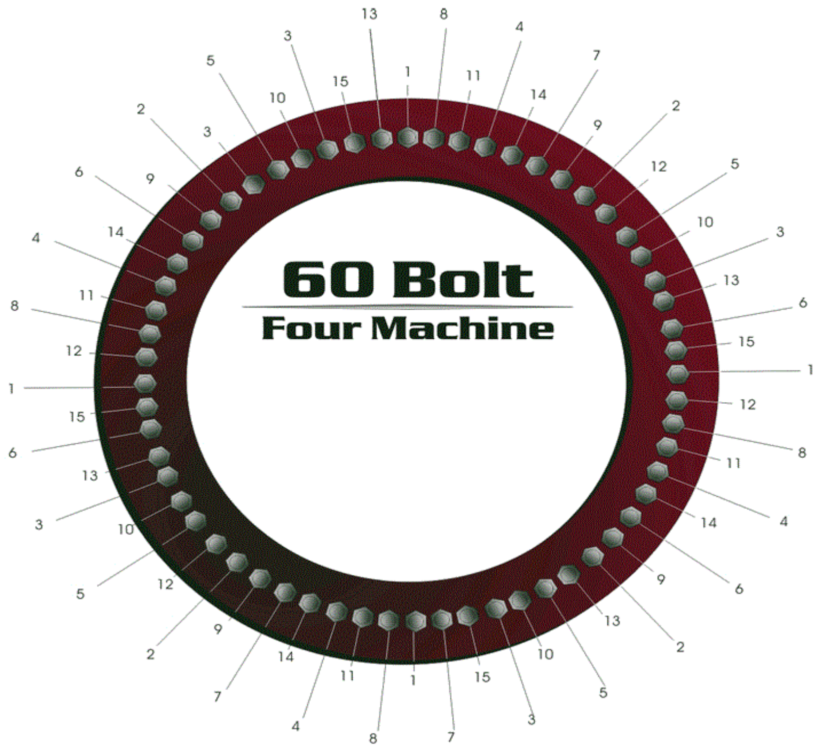
PASS 6 TORQUE:________________________ PUMP PSI:________________

Signature:____
HYTORC/Contractor

Signature:____
QA/QC

HYTORC®

60 BOLT



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COMPANY:________________________

TECHNICIAN:_______________________

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FLANGE IDENTIFIER:_________________

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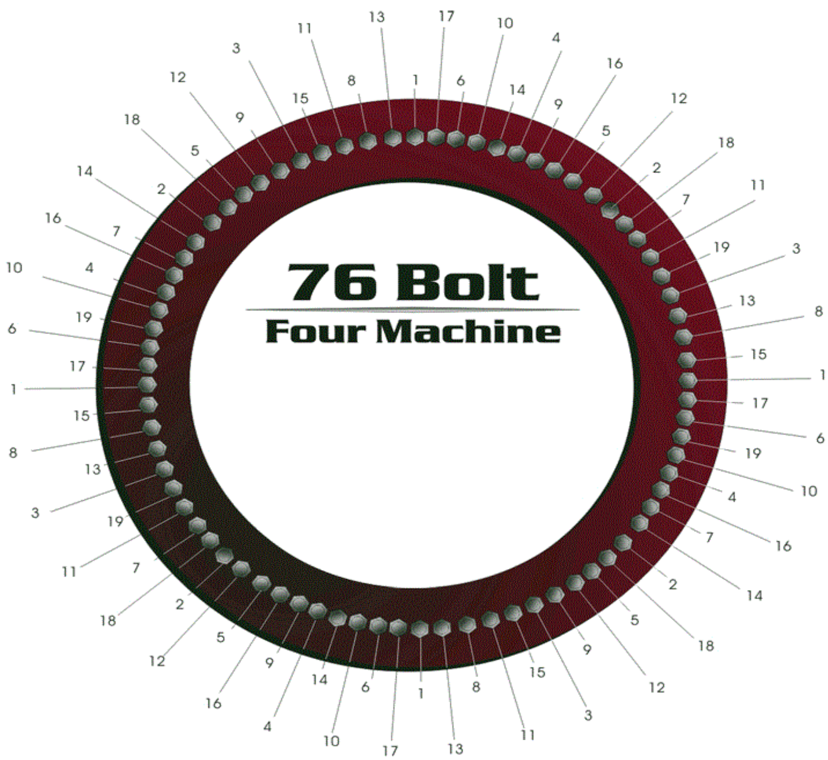
PASS 6 TORQUE:_____________________ PUMP PSI:_______________

Signature:_______________________________________
HYTORC/Contractor

Signature:____
QA/QC

HYTORC®

76 BOLT



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COMPANY:________________________

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JOB LOCATION:_____________________

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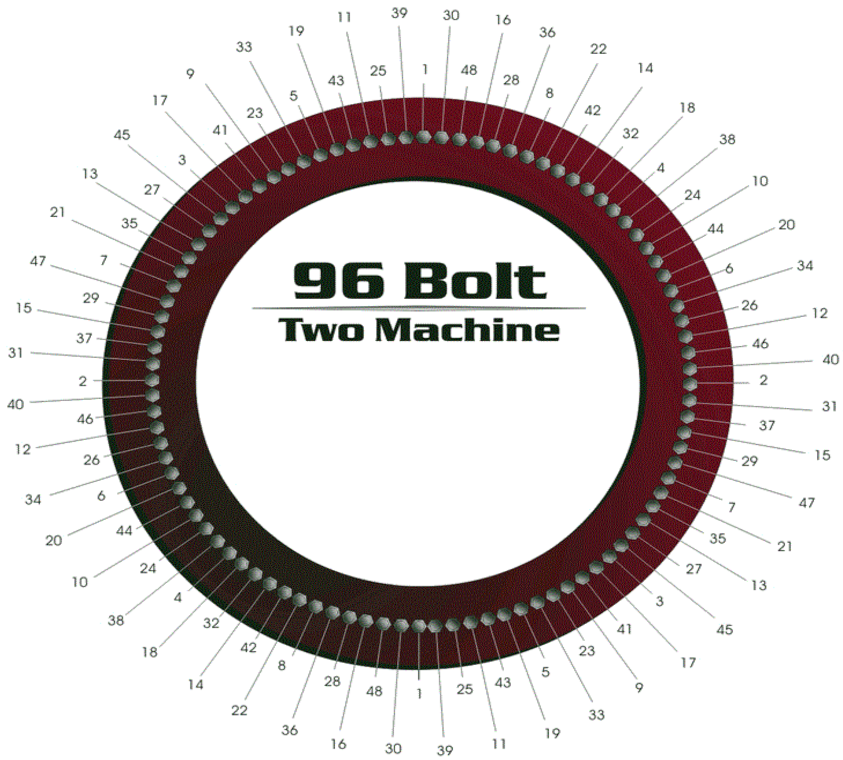
PASS 6 TORQUE:_____________________ PUMP PSI:_______________

Signature:______________________________________
HYTORC/Contractor

Signature:____
QA/QC

HYTORC®

96 BOLT



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PASS 6 TORQUE:____________________ PUMP PSI:______________

Signature:______________________________________ Signature:____

HYTORC/Contractor QA/QC

BOLT LOAD STAINLESS STEEL (MATERIAL B8M CLASS 1A)
40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR ASTM A193 GRADE **B8M Class 1A** STUD

BOLT TENSION BASED ON **40** PERCENT YIELD

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	BOLT SIZE (.001")	THREAD PER INCH	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	TS-801 MOLY DRY FILM SPRAY	MOLY DISULFIDE K=.100	MOLY/ LEAD OXIDE/ GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.3
1/2 x 13	0.5	13	7/8"	0.142	30,000	1,702	8	7	9	10	11	11	14	31	21
5/8 x 11	0.625	11	1-1/16"	0.226	30,000	2,711	15	14	18	20	21	22	28	62	42
3/4 x 10	0.75	10	1-1/4"	0.334	30,000	4,011	27	25	31	35	38	39	50	110	75
7/8 x 9	0.875	9	1-7/16"	0.461	30,000	5,538	44	40	50	57	61	63	81	178	121
1x 8	1	8	1-5/8"	0.605	30,000	7,265	66	61	76	85	91	95	121	266	182
1-1/8 x 8	1.125	8	1-13/16"	0.790	30,000	9,481	97	89	111	124	133	140	178	391	267
1-1/4 x 8	1.25	8	2"	0.999	30,000	11,990	136	125	156	175	187	196	250	550	375
1-3/8 x 8	1.375	8	2-3/16"	1.233	30,000	14,795	185	170	212	237	254	266	339	746	509
1-1/2 x 8	1.5	8	2-3/8"	1.491	30,000	17,893	244	224	280	313	335	351	447	984	671

TORQUE GUIDE FOR ASTM A193 GRADE **B8M Class 1A** STUD

BOLT TENSION BASED ON **50** PERCENT YIELD

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	BOLT SIZE (.001")	THREAD PER INCH	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	TS-801 MOLY DRY FILM SPRAY	MOLY DISULFIDE K=.100	MOLY/ LEAD OXIDE/ GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.3
1/2 x 13	0.5	13	7/8"	0.142	30,000	2,127	10	9	11	12	13	14	18	39	27
5/8 x 11	0.625	11	1-1/16"	0.226	30,000	3,388	19	18	22	25	26	28	35	78	53
3/4 x 10	0.75	10	1-1/4"	0.334	30,000	5,014	34	31	39	44	47	49	63	138	94
7/8 x 9	0.875	9	1-7/16"	0.461	30,000	6,922	55	50	63	71	76	79	101	222	151
1x 8	1	8	1-5/8"	0.605	30,000	9,082	82	76	95	106	114	119	151	333	227
1-1/8 x 8	1.125	8	1-13/16"	0.790	30,000	11,851	121	111	139	156	167	174	222	489	333
1-1/4 x 8	1.25	8	2"	0.999	30,000	14,988	170	156	195	219	234	245	312	687	468
1-3/8 x 8	1.375	8	2-3/16"	1.233	30,000	18,493	231	212	265	297	318	333	424	932	636
1-1/2 x 8	1.5	8	2-3/8"	1.491	30,000	22,366	305	280	349	391	419	439	559	1,230	839

TORQUE GUIDE FOR ASTM A193 GRADE **B8M Class 1A** STUD

BOLT TENSION BASED ON **60** PERCENT YIELD

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	BOLT SIZE (.001")	THREAD PER INCH	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	TS-801 MOLY DRY FILM SPRAY	MOLY DISULFIDE K=.100	MOLY/ LEAD OXIDE/ GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.3
1/2 x 13	0.5	13	7/8"	0.142	30,000	2,553	12	11	13	15	16	17	21	47	32
5/8 x 11	0.625	11	1-1/16"	0.226	30,000	4,066	23	21	26	30	32	33	42	93	64
3/4 x 10	0.75	10	1-1/4"	0.334	30,000	6,017	41	38	47	53	56	59	75	165	113
7/8 x 9	0.875	9	1-7/16"	0.461	30,000	8,307	66	61	76	85	91	95	121	267	182
1x 8	1	8	1-5/8"	0.605	30,000	10,898	99	91	114	127	136	143	182	400	272
1-1/8 x 8	1.125	8	1-13/16"	0.790	30,000	14,221	145	133	167	187	200	209	267	587	400
1-1/4 x 8	1.25	8	2"	0.999	30,000	17,986	204	187	234	262	281	294	375	824	562
1-3/8 x 8	1.375	8	2-3/16"	1.233	30,000	22,192	277	254	318	356	381	399	509	1,119	763
1-1/2 x 8	1.5	8	2-3/8"	1.491	30,000	26,840	366	335	419	470	503	527	671	1,476	1,006

TORQUE GUIDE FOR ASTM A193 GRADE **B8M Class 1A** STUD

BOLT TENSION BASED ON **70** PERCENT YIELD

BOLT SIZE DIA. x TPI	BOLT SIZE (.001")	THREAD PER INCH	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**REQUIRED TORQUE** (FtLbs) TS-801 MOLY DRY FILM SPRAY	MOLY DISULFIDE K=.100	MOLY/ LEAD OXIDE/ GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.3
1/2 x 13	0.5	13	7/8"	0.142	30,000	2,978	14	12	16	17	19	19	25	55	37
5/8 x 11	0.625	11	1-1/16"	0.226	30,000	4,744	27	25	31	35	37	39	49	109	74
3/4 x 10	0.75	10	1-1/4"	0.334	30,000	7,020	48	44	55	61	66	69	88	193	132
7/8 x 9	0.875	9	1-7/16"	0.461	30,000	9,691	77	71	88	99	106	111	141	311	212
1x 8	1	8	1-5/8"	0.605	30,000	12,714	115	106	132	148	159	166	212	466	318
1-1/8 x 8	1.125	8	1-13/16"	0.790	30,000	16,591	170	156	194	218	233	244	311	684	467
1-1/4 x 8	1.25	8	2"	0.999	30,000	20,983	238	219	273	306	328	343	437	962	656
1-3/8 x 8	1.375	8	2-3/16"	1.233	30,000	25,890	323	297	371	415	445	466	593	1,305	890
1-1/2 x 8	1.5	8	2-3/8"	1.491	30,000	31,313	427	391	489	548	587	615	783	1,722	1,174

TORQUE GUIDE FOR ASTM A193 GRADE **B8M Class 1A** STUD

BOLT TENSION BASED ON **80** PERCENT YIELD

BOLT SIZE DIA. x TPI	BOLT SIZE (.001")	THREAD PER INCH	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**REQUIRED TORQUE** (FtLbs) TS-801 MOLY DRY FILM SPRAY	MOLY DISULFIDE K=.100	MOLY/ LEAD OXIDE/ GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.3
1/2 x 13	0.5	13	7/8"	0.142	30,000	3,404	15	14	18	20	21	22	28	62	43
5/8 x 11	0.625	11	1-1/16"	0.226	30,000	5,421	31	28	35	40	42	44	56	124	85
3/4 x 10	0.75	10	1-1/4"	0.334	30,000	8,023	55	50	63	70	75	79	100	221	150
7/8 x 9	0.875	9	1-7/16"	0.461	30,000	11,076	88	81	101	113	121	127	162	355	242
1x 8	1	8	1-5/8"	0.605	30,000	14,530	132	121	151	170	182	190	242	533	363
1-1/8 x 8	1.125	8	1-13/16"	0.790	30,000	18,961	194	178	222	249	267	279	356	782	533
1-1/4 x 8	1.25	8	2"	0.999	30,000	23,981	272	250	312	350	375	392	500	1,099	749
1-3/8 x 8	1.375	8	2-3/16"	1.233	30,000	29,589	370	339	424	475	509	532	678	1,492	1,017
1-1/2 x 8	1.5	8	2-3/8"	1.491	30,000	35,786	488	447	559	626	671	702	895	1,968	1,342

TORQUE GUIDE FOR ASTM A193 GRADE **B8M Class 1A** STUD

BOLT TENSION BASED ON **90** PERCENT YIELD

BOLT SIZE DIA. x TPI	BOLT SIZE (.001")	THREAD PER INCH	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**REQUIRED TORQUE** (FtLbs) TS-801 MOLY DRY FILM SPRAY	MOLY DISULFIDE K=.100	MOLY/ LEAD OXIDE/ GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.3
1/2 x 13	0.5	13	7/8"	0.142	30,000	3,829	17	16	20	22	24	25	32	70	48
5/8 x 11	0.625	11	1-1/16"	0.226	30,000	6,099	35	32	40	44	48	50	64	140	95
3/4 x 10	0.75	10	1-1/4"	0.334	30,000	9,026	61	56	71	79	85	89	113	248	169
7/8 x 9	0.875	9	1-7/16"	0.461	30,000	12,460	99	91	114	127	136	143	182	400	273
1x 8	1	8	1-5/8"	0.605	30,000	16,347	148	136	170	191	204	214	272	599	409
1-1/8 x 8	1.125	8	1-13/16"	0.790	30,000	21,331	218	200	250	280	300	314	400	880	600
1-1/4 x 8	1.25	8	2"	0.999	30,000	26,978	306	281	351	393	422	441	562	1,237	843
1-3/8 x 8	1.375	8	2-3/16"	1.233	30,000	33,288	416	381	477	534	572	599	763	1,678	1,144
1-1/2 x 8	1.5	8	2-3/8"	1.491	30,000	40,259	549	503	629	705	755	790	1,006	2,214	1,510

TORQUE GUIDE FOR ASTM A193 GRADE **B8M Class 1A** STUD

BOLT TENSION BASED ON **99** PERCENT YIELD

BOLT SIZE DIA. x TPI	BOLT SIZE (.001")	THREAD PER INCH	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**REQUIRED TORQUE** (FtLbs) TS-801 MOLY DRY FILM SPRAY	MOLY DISULFIDE K=.100	MOLY/ LEAD OXIDE/ GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.3
1/2 x 13	0.5	13	7/8"	0.142	30,000	4,212	19	18	22	25	26	28	35	77	53
5/8 x 11	0.625	11	1-1/16"	0.226	30,000	6,709	38	35	44	49	52	55	70	154	105
3/4 x 10	0.75	10	1-1/4"	0.334	30,000	9,928	68	62	78	87	93	97	124	273	186
7/8 x 9	0.875	9	1-7/16"	0.461	30,000	13,707	109	100	125	140	150	157	200	440	300
1x 8	1	8	1-5/8"	0.605	30,000	17,981	163	150	187	210	225	235	300	659	450
1-1/8 x 8	1.125	8	1-13/16"	0.790	30,000	23,465	240	220	275	308	330	345	440	968	660
1-1/4 x 8	1.25	8	2"	0.999	30,000	29,676	337	309	386	433	464	485	618	1,360	927
1-3/8 x 8	1.375	8	2-3/16"	1.233	30,000	36,616	457	420	524	587	629	659	839	1,846	1,259
1-1/2 x 8	1.5	8	2-3/8"	1.491	30,000	44,285	603	554	692	775	830	869	1,107	2,436	1,661

BOLT LOAD STAINLESS STEEL (MATERIAL B8M CLASS 2)
40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR ASTM A193 GRADE **B8M Class 2** STUD

BOLT TENSION BASED ON **40** PERCENT YIELD

					REQUIRED TORQUE (FtLbs)								
BOLT SIZE DIA. x TPI	**HEX NUT ACROSS**	**STRESS AREA (IN^2)**	**MIN YIELD STRENGTH**	**BOLT TENSION**	TS801MOLY DRY FILM SPRAY	MOLYBDENUM DISULFIDE	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.109
3/4 x 10	1-1/4"	0.334	95,000	12,703	87	79	99	111	119	125	159	349	87
7/8 x 9	1-7/16"	0.461	80,000	14,768	117	108	135	151	162	169	215	474	117
1x 8	1-5/8"	0.605	80,000	19,374	176	161	202	226	242	253	323	710	176
1-1/8 x 8	1-13/16"	0.790	65,000	20,541	210	193	241	270	289	302	385	847	210
1-1/4 x 8	2"	0.999	65,000	25,979	295	271	338	379	406	425	541	1,191	295
1-3/8 x 8	2-3/16"	1.233	50,000	24,658	308	283	353	396	424	444	565	1,243	308
1-1/2 x 8	2-3/8"	1.491	50,000	29,822	406	373	466	522	559	585	746	1,640	406

TORQUE GUIDE FOR ASTM A193 GRADE **B8M Class 2** STUD

BOLT TENSION BASED ON **50** PERCENT YIELD

					REQUIRED TORQUE (FtLbs)								
BOLT SIZE DIA. x TPI	**HEX NUT ACROSS**	**STRESS AREA (IN^2)**	**MIN YIELD STRENGTH**	**BOLT TENSION**	TS801MOLY DRY FILM SPRAY	MOLYBDENUM DISULFIDE	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.109
3/4 x 10	1-1/4"	0.334	95,000	15,879	108	99	124	139	149	156	198	437	108
7/8 x 9	1-7/16"	0.461	80,000	18,460	147	135	168	188	202	211	269	592	147
1x 8	1-5/8"	0.605	80,000	24,217	220	202	252	283	303	317	404	888	220
1-1/8 x 8	1-13/16"	0.790	65,000	25,677	262	241	301	337	361	378	481	1,059	262
1-1/4 x 8	2"	0.999	65,000	32,474	369	338	423	474	507	531	677	1,488	369
1-3/8 x 8	2-3/16"	1.233	50,000	30,822	385	353	441	494	530	554	706	1,554	385
1-1/2 x 8	2-3/8"	1.491	50,000	37,277	508	466	582	652	699	732	932	2,050	508

TORQUE GUIDE FOR ASTM A193 GRADE **B8M Class 2** STUD

BOLT TENSION BASED ON **60** PERCENT YIELD

					REQUIRED TORQUE (FtLbs)								
BOLT SIZE DIA. x TPI	**HEX NUT ACROSS**	**STRESS AREA (IN^2)**	**MIN YIELD STRENGTH**	**BOLT TENSION**	TS801MOLY DRY FILM SPRAY	MOLYBDENUM DISULFIDE	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.109
3/4 x 10	1-1/4"	0.334	95,000	19,055	130	119	149	167	179	187	238	524	130
7/8 x 9	1-7/16"	0.461	80,000	22,152	176	162	202	226	242	254	323	711	176
1x 8	1-5/8"	0.605	80,000	29,061	264	242	303	339	363	380	484	1,066	264
1-1/8 x 8	1-13/16"	0.790	65,000	30,812	315	289	361	404	433	454	578	1,271	315
1-1/4 x 8	2"	0.999	65,000	38,969	442	406	507	568	609	637	812	1,786	442
1-3/8 x 8	2-3/16"	1.233	50,000	36,986	462	424	530	593	636	665	848	1,865	462
1-1/2 x 8	2-3/8"	1.491	50,000	44,733	609	559	699	783	839	878	1,118	2,460	609

TORQUE GUIDE FOR ASTM A193 GRADE **B8M Class 2** STUD

BOLT TENSION BASED ON **70** PERCENT YIELD

					REQUIRED TORQUE (FtLbs)								
BOLT SIZE DIA. x TPI	**HEX NUT ACROSS**	**STRESS AREA (IN^2)**	**MIN YIELD STRENGTH**	**BOLT TENSION**	TS801MOLY DRY FILM SPRAY	MOLYBDENUM DISULFIDE	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.109
3/4 x 10	1-1/4"	0.334	95,000	22,230	151	139	174	195	208	218	278	611	151
7/8 x 9	1-7/16"	0.461	80,000	25,844	205	188	236	264	283	296	377	829	205
1x 8	1-5/8"	0.605	80,000	33,904	308	283	353	396	424	444	565	1,243	308
1-1/8 x 8	1-13/16"	0.790	65,000	35,947	367	337	421	472	506	529	674	1,483	367
1-1/4 x 8	2"	0.999	65,000	45,464	516	474	592	663	710	744	947	2,084	516
1-3/8 x 8	2-3/16"	1.233	50,000	43,151	539	494	618	692	742	776	989	2,176	539
1-1/2 x 8	2-3/8"	1.491	50,000	52,188	711	652	815	913	979	1,024	1,305	2,870	711

TORQUE GUIDE FOR ASTM A193 GRADE **B8M Class 2** STUD

BOLT TENSION BASED ON **80** PERCENT YIELD

					REQUIRED TORQUE (FtLbs)								
BOLT SIZE DIA. x TPI	**HEX NUT ACROSS**	**STRESS AREA (IN^2)**	**MIN YIELD STRENGTH**	**BOLT TENSION**	TS801MOLY DRY FILM SPRAY	MOLYBDENUM DISULFIDE	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.109
3/4 x 10	1-1/4"	0.334	95,000	25,406	173	159	198	222	238	249	318	699	173
7/8 x 9	1-7/16"	0.461	80,000	29,536	235	215	269	302	323	338	431	948	235
1x 8	1-5/8"	0.605	80,000	38,748	352	323	404	452	484	507	646	1,421	352
1-1/8 x 8	1-13/16"	0.790	65,000	41,083	420	385	481	539	578	605	770	1,695	420
1-1/4 x 8	2"	0.999	65,000	51,958	590	541	677	758	812	850	1,082	2,381	590
1-3/8 x 8	2-3/16"	1.233	50,000	49,315	616	565	706	791	848	887	1,130	2,486	616
1-1/2 x 8	2-3/8"	1.491	50,000	59,643	813	746	932	1,044	1,118	1,171	1,491	3,280	813

TORQUE GUIDE FOR ASTM A193 GRADE **B8M Class 2** STUD

BOLT TENSION BASED ON **90** PERCENT YIELD

					REQUIRED TORQUE (FtLbs)								
BOLT SIZE DIA. x TPI	**HEX NUT ACROSS**	**STRESS AREA (IN^2)**	**MIN YIELD STRENGTH**	**BOLT TENSION**	TS801MOLY DRY FILM SPRAY	MOLYBDENUM DISULFIDE	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.109
3/4 x 10	1-1/4"	0.334	95,000	28,582	195	179	223	250	268	280	357	786	195
7/8 x 9	1-7/16"	0.461	80,000	33,228	264	242	303	339	363	380	485	1,066	264
1x 8	1-5/8"	0.605	80,000	43,591	396	363	454	509	545	570	727	1,598	396
1-1/8 x 8	1-13/16"	0.790	65,000	46,218	472	433	542	607	650	680	867	1,906	472
1-1/4 x 8	2"	0.999	65,000	58,453	664	609	761	852	913	956	1,218	2,679	664
1-3/8 x 8	2-3/16"	1.233	50,000	55,479	693	636	795	890	954	998	1,271	2,797	693
1-1/2 x 8	2-3/8"	1.491	50,000	67,099	914	839	1,048	1,174	1,258	1,317	1,677	3,690	914

TORQUE GUIDE FOR ASTM A193 GRADE **B8M Class 2** STUD

BOLT TENSION BASED ON **99** PERCENT YIELD

					REQUIRED TORQUE (FtLbs)								
BOLT SIZE DIA. x TPI	**HEX NUT ACROSS**	**STRESS AREA (IN^2)**	**MIN YIELD STRENGTH**	**BOLT TENSION**	TS801MOLY DRY FILM SPRAY	MOLYBDENUM DISULFIDE	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.109
3/4 x 10	1-1/4"	0.334	95,000	31,440	214	197	246	275	295	309	393	865	214
7/8 x 9	1-7/16"	0.461	80,000	36,551	291	267	333	373	400	418	533	1,173	291
1x 8	1-5/8"	0.605	80,000	47,951	436	400	499	559	599	627	799	1,758	436
1-1/8 x 8	1-13/16"	0.790	65,000	50,840	520	477	596	667	715	748	953	2,097	520
1-1/4 x 8	2"	0.999	65,000	64,298	730	670	837	938	1,005	1,052	1,340	2,947	730
1-3/8 x 8	2-3/16"	1.233	50,000	61,027	762	699	874	979	1,049	1,098	1,399	3,077	762
1-1/2 x 8	2-3/8"	1.491	50,000	73,809	1,006	923	1,153	1,292	1,384	1,448	1,845	4,059	1,006

BOLT LOAD IMPERIAL (GRADE 8.8 STUD)

40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR ISO **R898** GRADE **8.8** STUD					**REQUIRED TORQUE** (FtLbs)								
BOLT TENSION BASED ON			40	**PERCENT YIELD**									
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	96,000	12,837	87	80	100	112	120	126	160	241	100
7/8 x 9	1-7/16"	0.461	96,000	17,722	141	129	162	181	194	203	258	388	162
1x 8	1-5/8"	0.605	96,000	23,249	211	194	242	271	291	304	387	581	242
1-1/8 x 8	1-13/16"	0.790	96,000	30,338	310	284	356	398	427	447	569	853	356
1-1/4 x 8	2"	0.999	96,000	38,369	436	400	500	560	600	627	799	1,199	500
1-3/8 x 8	2-3/16"	1.233	96,000	47,342	591	542	678	759	814	852	1,085	1,627	678
1-1/2 x 8	2-3/8"	1.491	96,000	57,258	780	716	895	1,002	1,074	1,124	1,431	2,147	895
1-5/8 x 8	2-9/16"	1.774	96,000	68,115	1,005	922	1,153	1,291	1,384	1,448	1,845	2,767	1,153
1-3/4 x 8	2-3/4"	2.081	96,000	79,914	1,270	1,165	1,457	1,632	1,748	1,830	2,331	3,496	1,457
1-7/8 x 8	2-15/16"	2.413	96,000	92,655	1,578	1,448	1,810	2,027	2,172	2,273	2,895	4,343	1,810
2 x 8	3-1/8"	2.769	96,000	106,338	1,932	1,772	2,215	2,481	2,658	2,783	3,545	5,317	2,215
2-1/8 x 8	3-5/16"	3.150	96,000	120,964	2,335	2,142	2,678	2,999	3,213	3,363	4,284	6,426	2,678
2-1/4 x 8	3-1/2"	3.555	96,000	136,531	2,790	2,560	3,200	3,584	3,840	4,019	5,120	7,680	3,200
2-3/8 x 8	3-11/16"	3.985	96,000	153,040	3,302	3,029	3,786	4,240	4,543	4,755	6,058	9,087	3,786
2-1/2 x 8	3-7/8"	4.440	96,000	170,491	3,872	3,552	4,440	4,973	5,328	5,576	7,104	10,656	4,440
2-3/4 x 8	4-1/4"	5.422	96,000	208,220	5,201	4,772	5,965	6,680	7,158	7,492	9,543	14,315	5,965
3 x 8	4-5/8"	6.503	96,000	249,716	6,805	6,243	7,804	8,740	9,364	9,801	12,486	18,729	7,804
3-1/4 x 8	5"	7.682	96,000	294,981	8,708	7,989	9,986	11,185	11,984	12,543	15,978	23,967	9,986
3-1/2 x 8	5-3/8"	8.959	96,000	344,013	10,937	10,034	12,542	14,047	15,051	15,753	20,067	30,101	12,542
3-3/4 x 8	5-3/4"	10.334	96,000	396,813	13,516	12,400	15,501	17,361	18,601	19,469	24,801	37,201	15,501
4 x 8	6-1/8"	11.807	96,000	453,382	16,473	15,113	18,891	21,158	22,669	23,727	30,225	45,338	18,891
4-1/4 x 8	6-1/2"	13.378	96,000	513,718	19,832	18,194	22,743	25,472	27,291	28,565	36,388	54,583	22,743
4-1/2 x 8	6-7/8"	15.047	96,000	577,823	23,619	21,668	27,085	30,336	32,503	34,019	43,337	65,005	27,085
4-3/4 x 8	7-1/4"	16.815	96,000	645,695	27,859	25,559	31,948	35,782	38,338	40,127	51,118	76,676	31,948
5 x 8	7-5/8"	18.681	96,000	717,335	32,579	29,889	37,361	41,845	44,833	46,926	59,778	89,667	37,361
5-1/4 x 8	8"	20.644	96,000	792,744	37,804	34,683	43,353	48,556	52,024	54,452	69,365	104,048	43,353
5-1/2 x 8	8-3/8"	22.706	96,000	871,920	43,560	39,963	49,954	55,948	59,945	62,742	79,926	119,889	49,954
5-3/4 x 8	8-3/4"	24.866	96,000	954,865	49,872	45,754	57,192	64,056	68,631	71,834	91,508	137,262	57,192
6 x 8	9-1/8"	27.124	96,000	1,041,577	56,766	52,079	65,099	72,910	78,118	81,764	104,158	156,237	65,099

TORQUE GUIDE FOR ISO **R898** GRADE **8.8** STUD					REQUIRED TORQUE (FtLbs)								
BOLT TENSION BASED ON			50	PERCENT YIELD									
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	96,000	16,046	109	100	125	140	150	157	201	301	125
7/8 x 9	1-7/16"	0.461	96,000	22,152	176	162	202	226	242	254	323	485	202
1x 8	1-5/8"	0.605	96,000	29,061	264	242	303	339	363	380	484	727	303
1-1/8 x 8	1-13/16"	0.790	96,000	37,922	388	356	444	498	533	558	711	1,067	444
1-1/4 x 8	2"	0.999	96,000	47,961	545	500	624	699	749	784	999	1,499	624
1-3/8 x 8	2-3/16"	1.233	96,000	59,178	739	678	848	949	1,017	1,065	1,356	2,034	848
1-1/2 x 8	2-3/8"	1.491	96,000	71,572	975	895	1,118	1,253	1,342	1,405	1,789	2,684	1,118
1-5/8 x 8	2-9/16"	1.774	96,000	85,144	1,257	1,153	1,441	1,614	1,729	1,810	2,306	3,459	1,441
1-3/4 x 8	2-3/4"	2.081	96,000	99,893	1,588	1,457	1,821	2,039	2,185	2,287	2,914	4,370	1,821
1-7/8 x 8	2-15/16"	2.413	96,000	115,819	1,973	1,810	2,262	2,534	2,715	2,841	3,619	5,429	2,262
2 x 8	3-1/8"	2.769	96,000	132,923	2,415	2,215	2,769	3,102	3,323	3,478	4,431	6,646	2,769
2-1/8 x 8	3-5/16"	3.150	96,000	151,205	2,919	2,678	3,347	3,749	4,016	4,204	5,355	8,033	3,347
2-1/4 x 8	3-1/2"	3.555	96,000	170,664	3,488	3,200	4,000	4,480	4,800	5,024	6,400	9,600	4,000
2-3/8 x 8	3-11/16"	3.985	96,000	191,300	4,127	3,786	4,733	5,301	5,679	5,944	7,572	11,358	4,733
2-1/2 x 8	3-7/8"	4.440	96,000	213,114	4,839	4,440	5,550	6,216	6,660	6,971	8,880	13,320	5,550
2-3/4 x 8	4-1/4"	5.422	96,000	260,275	6,501	5,965	7,456	8,350	8,947	9,364	11,929	17,894	7,456
3 x 8	4-5/8"	6.503	96,000	312,145	8,506	7,804	9,755	10,925	11,705	12,252	15,607	23,411	9,755
3-1/4 x 8	5"	7.682	96,000	368,726	10,885	9,986	12,483	13,981	14,979	15,679	19,973	29,959	12,483
3-1/2 x 8	5-3/8"	8.959	96,000	430,016	13,671	12,542	15,678	17,559	18,813	19,691	25,084	37,626	15,678
3-3/4 x 8	5-3/4"	10.334	96,000	496,017	16,896	15,501	19,376	21,701	23,251	24,336	31,001	46,502	19,376
4 x 8	6-1/8"	11.807	96,000	566,727	20,591	18,891	23,614	26,447	28,336	29,659	37,782	56,673	23,614
4-1/4 x 8	6-1/2"	13.378	96,000	642,148	24,790	22,743	28,428	31,840	34,114	35,706	45,485	68,228	28,428
4-1/2 x 8	6-7/8"	15.047	96,000	722,278	29,523	27,085	33,857	37,920	40,628	42,524	54,171	81,256	33,857
4-3/4 x 8	7-1/4"	16.815	96,000	807,119	34,824	31,948	39,936	44,728	47,923	50,159	63,897	95,845	39,936
5 x 8	7-5/8"	18.681	96,000	896,669	40,724	37,361	46,702	52,306	56,042	58,657	74,722	112,084	46,702
5-1/4 x 8	8"	20.644	96,000	990,930	47,255	43,353	54,191	60,694	65,030	68,064	86,706	130,060	54,191
5-1/2 x 8	8-3/8"	22.706	96,000	1,089,900	54,450	49,954	62,442	69,935	74,931	78,427	99,908	149,861	62,442
5-3/4 x 8	8-3/4"	24.866	96,000	1,193,581	62,340	57,192	71,491	80,069	85,789	89,792	114,385	171,577	71,491
6 x 8	9-1/8"	27.124	96,000	1,301,971	70,957	65,099	81,373	91,138	97,648	102,205	130,197	195,296	81,373

TORQUE GUIDE FOR ISO **R898** GRADE **8.8** STUD					REQUIRED TORQUE (FtLbs)								
BOLT TENSION BASED ON			60	PERCENT YIELD									
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	96,000	19,255	131	120	150	168	181	189	241	361	150
7/8 x 9	1-7/16"	0.461	96,000	26,582	211	194	242	271	291	304	388	581	242
1x 8	1-5/8"	0.605	96,000	34,873	317	291	363	407	436	456	581	872	363
1-1/8 x 8	1-13/16"	0.790	96,000	45,507	465	427	533	597	640	670	853	1,280	533
1-1/4 x 8	2"	0.999	96,000	57,554	653	600	749	839	899	941	1,199	1,799	749
1-3/8 x 8	2-3/16"	1.233	96,000	71,014	887	814	1,017	1,139	1,221	1,278	1,627	2,441	1,017
1-1/2 x 8	2-3/8"	1.491	96,000	85,886	1,170	1,074	1,342	1,503	1,610	1,686	2,147	3,221	1,342
1-5/8 x 8	2-9/16"	1.774	96,000	102,172	1,508	1,384	1,729	1,937	2,075	2,172	2,767	4,151	1,729
1-3/4 x 8	2-3/4"	2.081	96,000	119,871	1,905	1,748	2,185	2,447	2,622	2,745	3,496	5,244	2,185
1-7/8 x 8	2-15/16"	2.413	96,000	138,983	2,367	2,172	2,715	3,040	3,257	3,409	4,343	6,515	2,715
2 x 8	3-1/8"	2.769	96,000	159,508	2,898	2,658	3,323	3,722	3,988	4,174	5,317	7,975	3,323
2-1/8 x 8	3-5/16"	3.150	96,000	181,445	3,502	3,213	4,016	4,498	4,820	5,045	6,426	9,639	4,016
2-1/4 x 8	3-1/2"	3.555	96,000	204,796	4,186	3,840	4,800	5,376	5,760	6,029	7,680	11,520	4,800
2-3/8 x 8	3-11/16"	3.985	96,000	229,560	4,952	4,543	5,679	6,361	6,815	7,133	9,087	13,630	5,679
2-1/2 x 8	3-7/8"	4.440	96,000	255,737	5,807	5,328	6,660	7,459	7,992	8,365	10,656	15,984	6,660
2-3/4 x 8	4-1/4"	5.422	96,000	312,330	7,802	7,158	8,947	10,021	10,736	11,237	14,315	21,473	8,947
3 x 8	4-5/8"	6.503	96,000	374,574	10,207	9,364	11,705	13,110	14,047	14,702	18,729	28,093	11,705
3-1/4 x 8	5"	7.682	96,000	442,471	13,062	11,984	14,979	16,777	17,975	18,814	23,967	35,951	14,979
3-1/2 x 8	5-3/8"	8.959	96,000	516,019	16,405	15,051	18,813	21,071	22,576	23,629	30,101	45,152	18,813
3-3/4 x 8	5-3/4"	10.334	96,000	595,220	20,275	18,601	23,251	26,041	27,901	29,203	37,201	55,802	23,251
4 x 8	6-1/8"	11.807	96,000	680,073	24,709	22,669	28,336	31,737	34,004	35,590	45,338	68,007	28,336
4-1/4 x 8	6-1/2"	13.378	96,000	770,577	29,747	27,291	34,114	38,208	40,937	42,847	54,583	81,874	34,114
4-1/2 x 8	6-7/8"	15.047	96,000	866,734	35,428	32,503	40,628	45,504	48,754	51,029	65,005	97,508	40,628
4-3/4 x 8	7-1/4"	16.815	96,000	968,543	41,789	38,338	47,923	53,673	57,507	60,191	76,676	115,014	47,923
5 x 8	7-5/8"	18.681	96,000	1,076,003	48,868	44,833	56,042	62,767	67,250	70,389	89,667	134,500	56,042
5-1/4 x 8	8"	20.644	96,000	1,189,116	56,706	52,024	65,030	72,833	78,036	81,677	104,048	156,071	65,030
5-1/2 x 8	8-3/8"	22.706	96,000	1,307,880	65,340	59,945	74,931	83,922	89,917	94,113	119,889	179,834	74,931
5-3/4 x 8	8-3/4"	24.866	96,000	1,432,297	74,808	68,631	85,789	96,083	102,946	107,751	137,262	205,893	85,789
6 x 8	9-1/8"	27.124	96,000	1,562,366	85,149	78,118	97,648	109,366	117,177	122,646	156,237	234,355	97,648

TORQUE GUIDE FOR ISO **R898** GRADE **8.8** STUD BOLT TENSION BASED ON 70 **PERCENT YIELD**					**REQUIRED TORQUE** (FtLbs)								
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	96,000	22,464	153	140	176	197	211	220	281	421	176
7/8 x 9	1-7/16"	0.461	96,000	31,013	246	226	283	317	339	355	452	678	283
1x 8	1-5/8"	0.605	96,000	40,685	370	339	424	475	509	532	678	1,017	424
1-1/8 x 8	1-13/16"	0.790	96,000	53,091	543	498	622	697	747	781	995	1,493	622
1-1/4 x 8	2"	0.999	96,000	67,146	762	699	874	979	1,049	1,098	1,399	2,098	874
1-3/8 x 8	2-3/16"	1.233	96,000	82,849	1,035	949	1,187	1,329	1,424	1,490	1,899	2,848	1,187
1-1/2 x 8	2-3/8"	1.491	96,000	100,201	1,365	1,253	1,566	1,754	1,879	1,966	2,505	3,758	1,566
1-5/8 x 8	2-9/16"	1.774	96,000	119,201	1,759	1,614	2,018	2,260	2,421	2,534	3,228	4,843	2,018
1-3/4 x 8	2-3/4"	2.081	96,000	139,850	2,223	2,039	2,549	2,855	3,059	3,202	4,079	6,118	2,549
1-7/8 x 8	2-15/16"	2.413	96,000	162,147	2,762	2,534	3,167	3,547	3,800	3,978	5,067	7,601	3,167
2 x 8	3-1/8"	2.769	96,000	186,092	3,381	3,102	3,877	4,342	4,652	4,869	6,203	9,305	3,877
2-1/8 x 8	3-5/16"	3.150	96,000	211,686	4,086	3,749	4,686	5,248	5,623	5,885	7,497	11,246	4,686
2-1/4 x 8	3-1/2"	3.555	96,000	238,929	4,883	4,480	5,600	6,272	6,720	7,033	8,960	13,440	5,600
2-3/8 x 8	3-11/16"	3.985	96,000	267,820	5,778	5,301	6,626	7,421	7,951	8,322	10,601	15,902	6,626
2-1/2 x 8	3-7/8"	4.440	96,000	298,360	6,775	6,216	7,770	8,702	9,324	9,759	12,432	18,647	7,770
2-3/4 x 8	4-1/4"	5.422	96,000	364,384	9,102	8,350	10,438	11,691	12,526	13,110	16,701	25,051	10,438
3 x 8	4-5/8"	6.503	96,000	437,003	11,908	10,925	13,656	15,295	16,388	17,152	21,850	32,775	13,656
3-1/4 x 8	5"	7.682	96,000	516,216	15,239	13,981	17,476	19,573	20,971	21,950	27,962	41,943	17,476
3-1/2 x 8	5-3/8"	8.959	96,000	602,023	19,139	17,559	21,949	24,583	26,338	27,568	35,118	52,677	21,949
3-3/4 x 8	5-3/4"	10.334	96,000	694,423	23,654	21,701	27,126	30,381	32,551	34,070	43,401	65,102	27,126
4 x 8	6-1/8"	11.807	96,000	793,418	28,828	26,447	33,059	37,026	39,671	41,522	52,895	79,342	33,059
4-1/4 x 8	6-1/2"	13.378	96,000	899,007	34,705	31,840	39,800	44,576	47,760	49,989	63,680	95,519	39,800
4-1/2 x 8	6-7/8"	15.047	96,000	1,011,190	41,332	37,920	47,400	53,087	56,879	59,534	75,839	113,759	47,400
4-3/4 x 8	7-1/4"	16.815	96,000	1,129,966	48,753	44,728	55,910	62,619	67,092	70,223	89,456	134,184	55,910
5 x 8	7-5/8"	18.681	96,000	1,255,337	57,013	52,306	65,382	73,228	78,459	82,120	104,611	156,917	65,382
5-1/4 x 8	8"	20.644	96,000	1,387,302	66,157	60,694	75,868	84,972	91,042	95,290	121,389	182,083	75,868
5-1/2 x 8	8-3/8"	22.706	96,000	1,525,861	76,229	69,935	87,419	97,909	104,903	109,798	139,871	209,806	87,419
5-3/4 x 8	8-3/4"	24.866	96,000	1,671,013	87,276	80,069	100,087	112,097	120,104	125,709	160,139	240,208	100,087
6 x 8	9-1/8"	27.124	96,000	1,822,760	99,340	91,138	113,923	127,593	136,707	143,087	182,276	273,414	113,923

TORQUE GUIDE FOR ISO **R898** GRADE **8.8** STUD BOLT TENSION BASED ON 80 **PERCENT YIELD**					**REQUIRED TORQUE** (FtLbs)								
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	96,000	25,674	175	160	201	225	241	252	321	481	201
7/8 x 9	1-7/16"	0.461	96,000	35,443	282	258	323	362	388	406	517	775	323
1x 8	1-5/8"	0.605	96,000	46,498	422	387	484	542	581	608	775	1,162	484
1-1/8 x 8	1-13/16"	0.790	96,000	60,676	620	569	711	796	853	893	1,138	1,707	711
1-1/4 x 8	2"	0.999	96,000	76,738	871	799	999	1,119	1,199	1,255	1,599	2,398	999
1-3/8 x 8	2-3/16"	1.233	96,000	94,685	1,183	1,085	1,356	1,519	1,627	1,703	2,170	3,255	1,356
1-1/2 x 8	2-3/8"	1.491	96,000	114,515	1,560	1,431	1,789	2,004	2,147	2,247	2,863	4,294	1,789
1-5/8 x 8	2-9/16"	1.774	96,000	136,230	2,011	1,845	2,306	2,583	2,767	2,896	3,690	5,534	2,306
1-3/4 x 8	2-3/4"	2.081	96,000	159,828	2,541	2,331	2,914	3,263	3,496	3,659	4,662	6,992	2,914
1-7/8 x 8	2-15/16"	2.413	96,000	185,310	3,156	2,895	3,619	4,054	4,343	4,546	5,791	8,686	3,619
2 x 8	3-1/8"	2.769	96,000	212,677	3,864	3,545	4,431	4,962	5,317	5,565	7,089	10,634	4,431
2-1/8 x 8	3-5/16"	3.150	96,000	241,927	4,670	4,284	5,355	5,998	6,426	6,726	8,568	12,852	5,355
2-1/4 x 8	3-1/2"	3.555	96,000	273,062	5,581	5,120	6,400	7,168	7,680	8,038	10,240	15,360	6,400
2-3/8 x 8	3-11/16"	3.985	96,000	306,080	6,603	6,058	7,572	8,481	9,087	9,511	12,116	18,174	7,572
2-1/2 x 8	3-7/8"	4.440	96,000	340,983	7,743	7,104	8,880	9,945	10,656	11,153	14,208	21,311	8,880
2-3/4 x 8	4-1/4"	5.422	96,000	416,439	10,402	9,543	11,929	13,361	14,315	14,983	19,087	28,630	11,929
3 x 8	4-5/8"	6.503	96,000	499,432	13,610	12,486	15,607	17,480	18,729	19,603	24,972	37,457	15,607
3-1/4 x 8	5"	7.682	96,000	589,961	17,416	15,978	19,973	22,369	23,967	25,086	31,956	47,934	19,973
3-1/2 x 8	5-3/8"	8.959	96,000	688,026	21,873	20,067	25,084	28,094	30,101	31,506	40,135	60,202	25,084
3-3/4 x 8	5-3/4"	10.334	96,000	793,627	27,033	24,801	31,001	34,721	37,201	38,937	49,602	74,403	31,001
4 x 8	6-1/8"	11.807	96,000	906,764	32,946	30,225	37,782	42,316	45,338	47,454	60,451	90,676	37,782
4-1/4 x 8	6-1/2"	13.378	96,000	1,027,436	39,663	36,388	45,485	50,944	54,583	57,130	72,777	109,165	45,485
4-1/2 x 8	6-7/8"	15.047	96,000	1,155,645	47,237	43,337	54,171	60,671	65,005	68,039	86,673	130,010	54,171
4-3/4 x 8	7-1/4"	16.815	96,000	1,291,390	55,718	51,118	63,897	71,565	76,676	80,255	102,235	153,353	63,897
5 x 8	7-5/8"	18.681	96,000	1,434,671	65,158	59,778	74,722	83,689	89,667	93,851	119,556	179,334	74,722
5-1/4 x 8	8"	20.644	96,000	1,585,488	75,608	69,365	86,706	97,111	104,048	108,903	138,730	208,095	86,706
5-1/2 x 8	8-3/8"	22.706	96,000	1,743,841	87,119	79,926	99,908	111,896	119,889	125,484	159,852	239,778	99,908
5-3/4 x 8	8-3/4"	24.866	96,000	1,909,729	99,744	91,508	114,385	128,111	137,262	143,667	183,016	274,524	114,385
6 x 8	9-1/8"	27.124	96,000	2,083,154	113,532	104,158	130,197	145,821	156,237	163,528	208,315	312,473	130,197

TORQUE GUIDE FOR ISO **R898** GRADE **8.8** STUD

BOLT TENSION BASED ON 90 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	96,000	28,883	197	181	226	253	271	283	361	542	226
7/8 x 9	1-7/16"	0.461	96,000	39,874	317	291	363	407	436	456	581	872	363
1x 8	1-5/8"	0.605	96,000	52,310	475	436	545	610	654	684	872	1,308	545
1-1/8 x 8	1-13/16"	0.790	96,000	68,260	698	640	800	896	960	1,005	1,280	1,920	800
1-1/4 x 8	2"	0.999	96,000	86,331	980	899	1,124	1,259	1,349	1,412	1,799	2,698	1,124
1-3/8 x 8	2-3/16"	1.233	96,000	106,520	1,330	1,221	1,526	1,709	1,831	1,916	2,441	3,662	1,526
1-1/2 x 8	2-3/8"	1.491	96,000	128,830	1,755	1,610	2,013	2,255	2,416	2,528	3,221	4,831	2,013
1-5/8 x 8	2-9/16"	1.774	96,000	153,258	2,262	2,075	2,594	2,906	3,113	3,258	4,151	6,226	2,594
1-3/4 x 8	2-3/4"	2.081	96,000	179,807	2,858	2,622	3,278	3,671	3,933	4,117	5,244	7,867	3,278
1-7/8 x 8	2-15/16"	2.413	96,000	208,474	3,551	3,257	4,072	4,560	4,886	5,114	6,515	9,772	4,072
2 x 8	3-1/8"	2.769	96,000	239,262	4,347	3,988	4,985	5,583	5,982	6,261	7,975	11,963	4,985
2-1/8 x 8	3-5/16"	3.150	96,000	272,168	5,253	4,820	6,025	6,748	7,229	7,567	9,639	14,459	6,025
2-1/4 x 8	3-1/2"	3.555	96,000	307,194	6,278	5,760	7,200	8,064	8,640	9,043	11,520	17,280	7,200
2-3/8 x 8	3-11/16"	3.985	96,000	344,340	7,428	6,815	8,519	9,541	10,223	10,700	13,630	20,445	8,519
2-1/2 x 8	3-7/8"	4.440	96,000	383,605	8,711	7,992	9,990	11,188	11,988	12,547	15,984	23,975	9,990
2-3/4 x 8	4-1/4"	5.422	96,000	468,494	11,703	10,736	13,420	15,031	16,104	16,856	21,473	32,209	13,420
3 x 8	4-5/8"	6.503	96,000	561,861	15,311	14,047	17,558	19,665	21,070	22,053	28,093	42,140	17,558
3-1/4 x 8	5"	7.682	96,000	663,706	19,593	17,975	22,469	25,166	26,963	28,221	35,951	53,926	22,469
3-1/2 x 8	5-3/8"	8.959	96,000	774,029	24,608	22,576	28,220	31,606	33,864	35,444	45,152	67,728	28,220
3-3/4 x 8	5-3/4"	10.334	96,000	892,830	30,412	27,901	34,876	39,061	41,851	43,804	55,802	83,703	34,876
4 x 8	6-1/8"	11.807	96,000	1,020,109	37,064	34,004	42,505	47,605	51,005	53,386	68,007	102,011	42,505
4-1/4 x 8	6-1/2"	13.378	96,000	1,155,866	44,621	40,937	51,171	57,312	61,405	64,271	81,874	122,811	51,171
4-1/2 x 8	6-7/8"	15.047	96,000	1,300,101	53,142	48,754	60,942	68,255	73,131	76,543	97,508	146,261	60,942
4-3/4 x 8	7-1/4"	16.815	96,000	1,452,814	62,683	57,507	71,884	80,510	86,261	90,286	115,014	172,522	71,884
5 x 8	7-5/8"	18.681	96,000	1,614,005	73,303	67,250	84,063	94,150	100,875	105,583	134,500	201,751	84,063
5-1/4 x 8	8"	20.644	96,000	1,783,674	85,059	78,036	97,545	109,250	117,054	122,516	156,071	234,107	97,545
5-1/2 x 8	8-3/8"	22.706	96,000	1,961,821	98,009	89,917	112,396	125,883	134,875	141,169	179,834	269,750	112,396
5-3/4 x 8	8-3/4"	24.866	96,000	2,148,446	112,212	102,946	128,683	144,125	154,420	161,626	205,893	308,839	128,683
6 x 8	9-1/8"	27.124	96,000	2,343,549	127,723	117,177	146,472	164,048	175,766	183,969	234,355	351,532	146,472

TORQUE GUIDE FOR ISO **R898** GRADE **8.8** STUD

BOLT TENSION BASED ON 99 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	96,000	31,771	216	199	248	278	298	312	397	596	248
7/8 x 9	1-7/16"	0.461	96,000	43,861	349	320	400	448	480	502	640	959	400
1x 8	1-5/8"	0.605	96,000	57,541	523	480	599	671	719	753	959	1,439	599
1-1/8 x 8	1-13/16"	0.790	96,000	75,087	767	704	880	986	1,056	1,105	1,408	2,112	880
1-1/4 x 8	2"	0.999	96,000	94,964	1,078	989	1,237	1,385	1,484	1,553	1,978	2,968	1,237
1-3/8 x 8	2-3/16"	1.233	96,000	117,172	1,463	1,343	1,678	1,880	2,014	2,108	2,685	4,028	1,678
1-1/2 x 8	2-3/8"	1.491	96,000	141,713	1,931	1,771	2,214	2,480	2,657	2,781	3,543	5,314	2,214
1-5/8 x 8	2-9/16"	1.774	96,000	168,584	2,488	2,283	2,854	3,196	3,424	3,584	4,566	6,849	2,854
1-3/4 x 8	2-3/4"	2.081	96,000	197,787	3,144	2,884	3,605	4,038	4,327	4,529	5,769	8,653	3,605
1-7/8 x 8	2-15/16"	2.413	96,000	229,322	3,906	3,583	4,479	5,016	5,375	5,626	7,166	10,749	4,479
2 x 8	3-1/8"	2.769	96,000	263,188	4,781	4,386	5,483	6,141	6,580	6,887	8,773	13,159	5,483
2-1/8 x 8	3-5/16"	3.150	96,000	299,385	5,779	5,302	6,627	7,422	7,952	8,324	10,603	15,905	6,627
2-1/4 x 8	3-1/2"	3.555	96,000	337,914	6,906	6,336	7,920	8,870	9,504	9,947	12,672	19,008	7,920
2-3/8 x 8	3-11/16"	3.985	96,000	378,774	8,171	7,497	9,371	10,495	11,245	11,770	14,993	22,490	9,371
2-1/2 x 8	3-7/8"	4.440	96,000	421,966	9,582	8,791	10,989	12,307	13,186	13,802	17,582	26,373	10,989
2-3/4 x 8	4-1/4"	5.422	96,000	515,344	12,873	11,810	14,762	16,534	17,715	18,542	23,620	35,430	14,762
3 x 8	4-5/8"	6.503	96,000	618,047	16,842	15,451	19,314	21,632	23,177	24,258	30,902	46,354	19,314
3-1/4 x 8	5"	7.682	96,000	730,077	21,552	19,773	24,716	27,682	29,659	31,043	39,546	59,319	24,716
3-1/2 x 8	5-3/8"	8.959	96,000	851,432	27,068	24,833	31,042	34,767	37,250	38,988	49,667	74,500	31,042
3-3/4 x 8	5-3/4"	10.334	96,000	982,113	33,453	30,691	38,364	42,967	46,037	48,185	61,382	92,073	38,364
4 x 8	6-1/8"	11.807	96,000	1,122,120	40,770	37,404	46,755	52,366	56,106	58,724	74,808	112,212	46,755
4-1/4 x 8	6-1/2"	13.378	96,000	1,271,453	49,083	45,031	56,288	63,043	67,546	70,698	90,061	135,092	56,288
4-1/2 x 8	6-7/8"	15.047	96,000	1,430,111	58,456	53,629	67,036	75,081	80,444	84,198	107,258	160,887	67,036
4-3/4 x 8	7-1/4"	16.815	96,000	1,598,095	68,951	63,258	79,072	88,561	94,887	99,315	126,516	189,774	79,072
5 x 8	7-5/8"	18.681	96,000	1,775,405	80,633	73,975	92,469	103,565	110,963	116,141	147,950	221,926	92,469
5-1/4 x 8	8"	20.644	96,000	1,962,041	93,565	85,839	107,299	120,175	128,759	134,768	171,679	257,518	107,299
5-1/2 x 8	8-3/8"	22.706	96,000	2,158,003	107,810	98,908	123,636	138,472	148,363	155,286	197,817	296,725	123,636
5-3/4 x 8	8-3/4"	24.866	96,000	2,363,290	123,433	113,241	141,551	158,537	169,861	177,788	226,482	339,723	141,551
6 x 8	9-1/8"	27.124	96,000	2,577,903	140,496	128,895	161,119	180,453	193,343	202,365	257,790	386,686	161,119

BOLT LOAD IMPERIAL (GRADE 10.9)
40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR ISO **R898** GRADE **10.9** STUD

BOLT TENSION BASED ON 40 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	136,000	18,185	124	114	142	159	170	178	227	341	142
7/8 x 9	1-7/16"	0.461	136,000	25,106	200	183	229	256	275	287	366	549	229
1x 8	1-5/8"	0.605	136,000	32,936	299	274	343	384	412	431	549	823	343
1-1/8 x 8	1-13/16"	0.790	136,000	42,979	439	403	504	564	604	633	806	1,209	504
1-1/4 x 8	2"	0.999	136,000	54,356	617	566	708	793	849	889	1,132	1,699	708
1-3/8 x 8	2-3/16"	1.233	136,000	67,068	838	768	961	1,076	1,153	1,207	1,537	2,305	961
1-1/2 x 8	2-3/8"	1.491	136,000	81,115	1,105	1,014	1,267	1,420	1,521	1,592	2,028	3,042	1,267
1-5/8 x 8	2-9/16"	1.774	136,000	96,496	1,424	1,307	1,633	1,829	1,960	2,052	2,613	3,920	1,633
1-3/4 x 8	2-3/4"	2.081	136,000	113,212	1,800	1,651	2,064	2,311	2,477	2,592	3,302	4,953	2,064
1-7/8 x 8	2-15/16"	2.413	136,000	131,262	2,236	2,051	2,564	2,871	3,076	3,220	4,102	6,153	2,564
2 x 8	3-1/8"	2.769	136,000	150,646	2,737	2,511	3,138	3,515	3,766	3,942	5,022	7,532	3,138
2-1/8 x 8	3-5/16"	3.150	136,000	171,365	3,308	3,035	3,793	4,248	4,552	4,764	6,069	9,104	3,793
2-1/4 x 8	3-1/2"	3.555	136,000	193,419	3,953	3,627	4,533	5,077	5,440	5,694	7,253	10,880	4,533
2-3/8 x 8	3-11/16"	3.985	136,000	216,807	4,677	4,291	5,364	6,007	6,436	6,737	8,582	12,873	5,364
2-1/2 x 8	3-7/8"	4.440	136,000	241,529	5,485	5,032	6,290	7,045	7,548	7,900	10,064	15,096	6,290
2-3/4 x 8	4-1/4"	5.422	136,000	294,978	7,368	6,760	8,450	9,464	10,140	10,613	13,520	20,280	8,450
3 x 8	4-5/8"	6.503	136,000	353,765	9,640	8,844	11,055	12,382	13,266	13,885	17,688	26,532	11,055
3-1/4 x 8	5"	7.682	136,000	417,889	12,336	11,318	14,147	15,845	16,977	17,769	22,636	33,953	14,147
3-1/2 x 8	5-3/8"	8.959	136,000	487,352	15,494	14,214	17,768	19,900	21,322	22,317	28,429	42,643	17,768
3-3/4 x 8	5-3/4"	10.334	136,000	562,152	19,148	17,567	21,959	24,594	26,351	27,581	35,135	52,702	21,959
4 x 8	6-1/8"	11.807	136,000	642,291	23,337	21,410	26,762	29,974	32,115	33,613	42,819	64,229	26,762
4-1/4 x 8	6-1/2"	13.378	136,000	727,767	28,095	25,775	32,219	36,085	38,663	40,467	51,550	77,325	32,219
4-1/2 x 8	6-7/8"	15.047	136,000	818,582	33,460	30,697	38,371	42,976	46,045	48,194	61,394	92,090	38,371
4-3/4 x 8	7-1/4"	16.815	136,000	914,735	39,467	36,208	45,260	50,692	54,312	56,847	72,416	108,625	45,260
5 x 8	7-5/8"	18.681	136,000	1,016,225	46,154	42,343	52,928	59,280	63,514	66,478	84,685	127,028	52,928
5-1/4 x 8	8"	20.644	136,000	1,123,054	53,556	49,134	61,417	68,787	73,700	77,140	98,267	147,401	61,417
5-1/2 x 8	8-3/8"	22.706	136,000	1,235,220	61,710	56,614	70,768	79,260	84,921	88,884	113,229	169,843	70,768
5-3/4 x 8	8-3/4"	24.866	136,000	1,352,725	70,652	64,818	81,023	90,745	97,227	101,764	129,636	194,454	81,023
6 x 8	9-1/8"	27.124	136,000	1,475,568	80,418	73,778	92,223	103,290	110,668	115,832	147,557	221,335	92,223

TORQUE GUIDE FOR ISO **R898** GRADE **10.9** STUD
BOLT TENSION BASED ON 50 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	136,000	22,732	155	142	178	199	213	223	284	426	178
7/8 x 9	1-7/16"	0.461	136,000	31,382	249	229	286	320	343	359	458	686	286
1x 8	1-5/8"	0.605	136,000	41,170	374	343	429	480	515	539	686	1,029	429
1-1/8 x 8	1-13/16"	0.790	136,000	53,724	549	504	630	705	755	791	1,007	1,511	630
1-1/4 x 8	2"	0.999	136,000	67,945	771	708	885	991	1,062	1,111	1,416	2,123	885
1-3/8 x 8	2-3/16"	1.233	136,000	83,836	1,047	961	1,201	1,345	1,441	1,508	1,921	2,882	1,201
1-1/2 x 8	2-3/8"	1.491	136,000	101,394	1,381	1,267	1,584	1,774	1,901	1,990	2,535	3,802	1,584
1-5/8 x 8	2-9/16"	1.774	136,000	120,620	1,780	1,633	2,042	2,287	2,450	2,564	3,267	4,900	2,042
1-3/4 x 8	2-3/4"	2.081	136,000	141,514	2,249	2,064	2,580	2,889	3,096	3,240	4,128	6,191	2,580
1-7/8 x 8	2-15/16"	2.413	136,000	164,077	2,794	2,564	3,205	3,589	3,846	4,025	5,127	7,691	3,205
2 x 8	3-1/8"	2.769	136,000	188,308	3,421	3,138	3,923	4,394	4,708	4,927	6,277	9,415	3,923
2-1/8 x 8	3-5/16"	3.150	136,000	214,206	4,135	3,793	4,742	5,311	5,690	5,955	7,586	11,380	4,742
2-1/4 x 8	3-1/2"	3.555	136,000	241,773	4,941	4,533	5,667	6,347	6,800	7,117	9,067	13,600	5,667
2-3/8 x 8	3-11/16"	3.985	136,000	271,008	5,846	5,364	6,705	7,509	8,046	8,421	10,727	16,091	6,705
2-1/2 x 8	3-7/8"	4.440	136,000	301,912	6,856	6,290	7,862	8,806	9,435	9,875	12,580	18,869	7,862
2-3/4 x 8	4-1/4"	5.422	136,000	368,722	9,210	8,450	10,562	11,830	12,675	13,266	16,900	25,350	10,562
3 x 8	4-5/8"	6.503	136,000	442,206	12,050	11,055	13,819	15,477	16,583	17,357	22,110	33,165	13,819
3-1/4 x 8	5"	7.682	136,000	522,361	15,421	14,147	17,684	19,806	21,221	22,211	28,295	42,442	17,684
3-1/2 x 8	5-3/8"	8.959	136,000	609,190	19,367	17,768	22,210	24,875	26,652	27,896	35,536	53,304	22,210
3-3/4 x 8	5-3/4"	10.334	136,000	702,690	23,935	21,959	27,449	30,743	32,939	34,476	43,918	65,877	27,449
4 x 8	6-1/8"	11.807	136,000	802,864	29,171	26,762	33,453	37,467	40,143	42,017	53,524	80,286	33,453
4-1/4 x 8	6-1/2"	13.378	136,000	909,709	35,119	32,219	40,274	45,106	48,328	50,584	64,438	96,657	40,274
4-1/2 x 8	6-7/8"	15.047	136,000	1,023,228	41,824	38,371	47,964	53,719	57,557	60,243	76,742	115,113	47,964
4-3/4 x 8	7-1/4"	16.815	136,000	1,143,418	49,334	45,260	56,575	63,364	67,890	71,059	90,521	135,781	56,575
5 x 8	7-5/8"	18.681	136,000	1,270,282	57,692	52,928	66,160	74,100	79,393	83,098	105,857	158,785	66,160
5-1/4 x 8	8"	20.644	136,000	1,403,817	66,945	61,417	76,771	85,984	92,126	96,425	122,834	184,251	76,771
5-1/2 x 8	8-3/8"	22.706	136,000	1,544,026	77,137	70,768	88,460	99,075	106,152	111,106	141,536	212,304	88,460
5-3/4 x 8	8-3/4"	24.866	136,000	1,690,906	88,315	81,023	101,278	113,432	121,534	127,205	162,045	243,068	101,278
6 x 8	9-1/8"	27.124	136,000	1,844,460	100,523	92,223	115,279	129,112	138,334	144,790	184,446	276,669	115,279

TORQUE GUIDE FOR ISO **R898** GRADE **10.9** STUD
BOLT TENSION BASED ON 60 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	136,000	27,278	186	170	213	239	256	268	341	511	213
7/8 x 9	1-7/16"	0.461	136,000	37,658	299	275	343	384	412	431	549	824	343
1x 8	1-5/8"	0.605	136,000	49,404	449	412	515	576	618	646	823	1,235	515
1-1/8 x 8	1-13/16"	0.790	136,000	64,468	659	604	755	846	907	949	1,209	1,813	755
1-1/4 x 8	2"	0.999	136,000	81,535	926	849	1,062	1,189	1,274	1,333	1,699	2,548	1,062
1-3/8 x 8	2-3/16"	1.233	136,000	100,603	1,256	1,153	1,441	1,614	1,729	1,810	2,305	3,458	1,441
1-1/2 x 8	2-3/8"	1.491	136,000	121,672	1,658	1,521	1,901	2,129	2,281	2,388	3,042	4,563	1,901
1-5/8 x 8	2-9/16"	1.774	136,000	144,744	2,136	1,960	2,450	2,744	2,940	3,077	3,920	5,880	2,450
1-3/4 x 8	2-3/4"	2.081	136,000	169,817	2,699	2,477	3,096	3,467	3,715	3,888	4,953	7,430	3,096
1-7/8 x 8	2-15/16"	2.413	136,000	196,892	3,353	3,076	3,846	4,307	4,615	4,830	6,153	9,229	3,846
2 x 8	3-1/8"	2.769	136,000	225,969	4,105	3,766	4,708	5,273	5,649	5,913	7,532	11,298	4,708
2-1/8 x 8	3-5/16"	3.150	136,000	257,048	4,962	4,552	5,690	6,373	6,828	7,146	9,104	13,656	5,690
2-1/4 x 8	3-1/2"	3.555	136,000	290,128	5,929	5,440	6,800	7,616	8,160	8,541	10,880	16,320	6,800
2-3/8 x 8	3-11/16"	3.985	136,000	325,210	7,016	6,436	8,046	9,011	9,655	10,105	12,873	19,309	8,046
2-1/2 x 8	3-7/8"	4.440	136,000	362,294	8,227	7,548	9,435	10,567	11,322	11,850	15,096	22,643	9,435
2-3/4 x 8	4-1/4"	5.422	136,000	442,467	11,052	10,140	12,675	14,196	15,210	15,920	20,280	30,420	12,675
3 x 8	4-5/8"	6.503	136,000	530,647	14,460	13,266	16,583	18,573	19,899	20,828	26,532	39,799	16,583
3-1/4 x 8	5"	7.682	136,000	626,834	18,505	16,977	21,221	23,767	25,465	26,653	33,953	50,930	21,221
3-1/2 x 8	5-3/8"	8.959	136,000	731,028	23,241	21,322	26,652	29,850	31,982	33,475	42,643	63,965	26,652
3-3/4 x 8	5-3/4"	10.334	136,000	843,228	28,722	26,351	32,939	36,891	39,526	41,371	52,702	79,053	32,939
4 x 8	6-1/8"	11.807	136,000	963,436	35,005	32,115	40,143	44,960	48,172	50,420	64,229	96,344	40,143
4-1/4 x 8	6-1/2"	13.378	136,000	1,091,651	42,142	38,663	48,328	54,128	57,994	60,700	77,325	115,988	48,328
4-1/2 x 8	6-7/8"	15.047	136,000	1,227,873	50,189	46,045	57,557	64,463	69,068	72,291	92,090	138,136	57,557
4-3/4 x 8	7-1/4"	16.815	136,000	1,372,102	59,200	54,312	67,890	76,037	81,469	85,270	108,625	162,937	67,890
5 x 8	7-5/8"	18.681	136,000	1,524,338	69,230	63,514	79,393	88,920	95,271	99,717	127,028	190,542	79,393
5-1/4 x 8	8"	20.644	136,000	1,684,581	80,333	73,700	92,126	103,181	110,551	115,710	147,401	221,101	92,126
5-1/2 x 8	8-3/8"	22.706	136,000	1,852,831	92,564	84,921	106,152	118,890	127,382	133,327	169,843	254,764	106,152
5-3/4 x 8	8-3/4"	24.866	136,000	2,029,088	105,978	97,227	121,534	136,118	145,841	152,647	194,454	291,681	121,534
6 x 8	9-1/8"	27.124	136,000	2,213,351	120,628	110,668	138,334	154,935	166,001	173,748	221,335	332,003	138,334

TORQUE GUIDE FOR ISO **R898** GRADE **10.9** STUD

BOLT TENSION BASED ON 70 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	136,000	31,824	217	199	249	278	298	312	398	597	249
7/8 x 9	1-7/16"	0.461	136,000	43,935	349	320	400	449	481	503	641	961	400
1x 8	1-5/8"	0.605	136,000	57,638	524	480	600	672	720	754	961	1,441	600
1-1/8 x 8	1-13/16"	0.790	136,000	75,213	769	705	881	987	1,058	1,107	1,410	2,115	881
1-1/4 x 8	2"	0.999	136,000	95,124	1,080	991	1,239	1,387	1,486	1,556	1,982	2,973	1,239
1-3/8 x 8	2-3/16"	1.233	136,000	117,370	1,466	1,345	1,681	1,883	2,017	2,111	2,690	4,035	1,681
1-1/2 x 8	2-3/8"	1.491	136,000	141,951	1,934	1,774	2,218	2,484	2,662	2,786	3,549	5,323	2,218
1-5/8 x 8	2-9/16"	1.774	136,000	168,868	2,493	2,287	2,858	3,201	3,430	3,590	4,574	6,860	2,858
1-3/4 x 8	2-3/4"	2.081	136,000	198,120	3,149	2,889	3,612	4,045	4,334	4,536	5,779	8,668	3,612
1-7/8 x 8	2-15/16"	2.413	136,000	229,708	3,912	3,589	4,486	5,025	5,384	5,635	7,178	10,768	4,486
2 x 8	3-1/8"	2.769	136,000	263,631	4,789	4,394	5,492	6,151	6,591	6,898	8,788	13,182	5,492
2-1/8 x 8	3-5/16"	3.150	136,000	299,889	5,788	5,311	6,638	7,435	7,966	8,338	10,621	15,932	6,638
2-1/4 x 8	3-1/2"	3.555	136,000	338,483	6,918	6,347	7,933	8,885	9,520	9,964	12,693	19,040	7,933
2-3/8 x 8	3-11/16"	3.985	136,000	379,412	8,185	7,509	9,386	10,513	11,264	11,789	15,018	22,528	9,386
2-1/2 x 8	3-7/8"	4.440	136,000	422,676	9,598	8,806	11,007	12,328	13,209	13,825	17,612	26,417	11,007
2-3/4 x 8	4-1/4"	5.422	136,000	516,211	12,895	11,830	14,787	16,562	17,745	18,573	23,660	35,490	14,787
3 x 8	4-5/8"	6.503	136,000	619,088	16,870	15,477	19,346	21,668	23,216	24,299	30,954	46,432	19,346
3-1/4 x 8	5"	7.682	136,000	731,306	21,589	19,806	24,758	27,729	29,709	31,096	39,612	59,419	24,758
3-1/2 x 8	5-3/8"	8.959	136,000	852,865	27,114	24,875	31,094	34,825	37,313	39,054	49,750	74,626	31,094
3-3/4 x 8	5-3/4"	10.334	136,000	983,767	33,510	30,743	38,428	43,040	46,114	48,266	61,485	92,228	38,428
4 x 8	6-1/8"	11.807	136,000	1,124,009	40,839	37,467	46,834	52,454	56,200	58,823	74,934	112,401	46,834
4-1/4 x 8	6-1/2"	13.378	136,000	1,273,593	49,166	45,106	56,383	63,149	67,660	70,817	90,213	135,319	56,383
4-1/2 x 8	6-7/8"	15.047	136,000	1,432,519	58,554	53,719	67,149	75,207	80,579	84,340	107,439	161,158	67,149
4-3/4 x 8	7-1/4"	16.815	136,000	1,600,786	69,067	63,364	79,206	88,710	95,047	99,482	126,729	190,093	79,206
5 x 8	7-5/8"	18.681	136,000	1,778,394	80,769	74,100	92,625	103,740	111,150	116,337	148,200	222,299	92,625
5-1/4 x 8	8"	20.644	136,000	1,965,344	93,722	85,984	107,480	120,377	128,976	134,995	171,968	257,951	107,480
5-1/2 x 8	8-3/8"	22.706	136,000	2,161,636	107,992	99,075	123,844	138,705	148,612	155,548	198,150	297,225	123,844
5-3/4 x 8	8-3/4"	24.866	136,000	2,367,269	123,640	113,432	141,790	158,804	170,147	178,088	226,863	340,295	141,790
6 x 8	9-1/8"	27.124	136,000	2,582,243	140,732	129,112	161,390	180,757	193,668	202,706	258,224	387,337	161,390

TORQUE GUIDE FOR ISO **R898** GRADE **10.9** STUD

BOLT TENSION BASED ON 80 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	136,000	36,371	248	227	284	318	341	357	455	682	284
7/8 x 9	1-7/16"	0.461	136,000	50,211	399	366	458	513	549	575	732	1,098	458
1x 8	1-5/8"	0.605	136,000	65,872	598	549	686	769	823	862	1,098	1,647	686
1-1/8 x 8	1-13/16"	0.790	136,000	85,958	878	806	1,007	1,128	1,209	1,265	1,612	2,418	1,007
1-1/4 x 8	2"	0.999	136,000	108,713	1,234	1,132	1,416	1,585	1,699	1,778	2,265	3,397	1,416
1-3/8 x 8	2-3/16"	1.233	136,000	134,137	1,675	1,537	1,921	2,152	2,305	2,413	3,074	4,611	1,921
1-1/2 x 8	2-3/8"	1.491	136,000	162,230	2,210	2,028	2,535	2,839	3,042	3,184	4,056	6,084	2,535
1-5/8 x 8	2-9/16"	1.774	136,000	192,992	2,849	2,613	3,267	3,659	3,920	4,103	5,227	7,840	3,267
1-3/4 x 8	2-3/4"	2.081	136,000	226,423	3,599	3,302	4,128	4,623	4,953	5,184	6,604	9,906	4,128
1-7/8 x 8	2-15/16"	2.413	136,000	262,523	4,471	4,102	5,127	5,743	6,153	6,440	8,204	12,306	5,127
2 x 8	3-1/8"	2.769	136,000	301,292	5,473	5,022	6,277	7,030	7,532	7,884	10,043	15,065	6,277
2-1/8 x 8	3-5/16"	3.150	136,000	342,730	6,615	6,069	7,586	8,497	9,104	9,529	12,138	18,208	7,586
2-1/4 x 8	3-1/2"	3.555	136,000	386,837	7,906	7,253	9,067	10,154	10,880	11,388	14,506	21,760	9,067
2-3/8 x 8	3-11/16"	3.985	136,000	433,614	9,354	8,582	10,727	12,015	12,873	13,474	17,164	25,746	10,727
2-1/2 x 8	3-7/8"	4.440	136,000	483,059	10,969	10,064	12,580	14,089	15,096	15,800	20,127	30,191	12,580
2-3/4 x 8	4-1/4"	5.422	136,000	589,956	14,737	13,520	16,900	18,928	20,280	21,226	27,040	40,559	16,900
3 x 8	4-5/8"	6.503	136,000	707,529	19,280	17,688	22,110	24,764	26,532	27,771	35,376	53,065	22,110
3-1/4 x 8	5"	7.682	136,000	835,778	24,673	22,636	28,295	31,690	33,953	35,538	45,271	67,907	28,295
3-1/2 x 8	5-3/8"	8.959	136,000	974,703	30,987	28,429	35,536	39,800	42,643	44,633	56,858	85,287	35,536
3-3/4 x 8	5-3/4"	10.334	136,000	1,124,305	38,297	35,135	43,918	49,188	52,702	55,161	70,269	105,404	43,918
4 x 8	6-1/8"	11.807	136,000	1,284,582	46,673	42,819	53,524	59,947	64,229	67,226	85,639	128,458	53,524
4-1/4 x 8	6-1/2"	13.378	136,000	1,455,535	56,190	51,550	64,438	72,170	77,325	80,934	103,100	154,651	64,438
4-1/2 x 8	6-7/8"	15.047	136,000	1,637,164	66,919	61,394	76,742	85,951	92,090	96,388	122,787	184,181	76,742
4-3/4 x 8	7-1/4"	16.815	136,000	1,829,469	78,934	72,416	90,521	101,383	108,625	113,694	144,833	217,249	90,521
5 x 8	7-5/8"	18.681	136,000	2,032,451	92,307	84,685	105,857	118,560	127,028	132,956	169,371	254,056	105,857
5-1/4 x 8	8"	20.644	136,000	2,246,108	107,111	98,267	122,834	137,574	147,401	154,280	196,534	294,802	122,834
5-1/2 x 8	8-3/8"	22.706	136,000	2,470,441	123,419	113,229	141,536	158,520	169,843	177,769	226,457	339,686	141,536
5-3/4 x 8	8-3/4"	24.866	136,000	2,705,450	141,303	129,636	162,045	181,491	194,454	203,529	259,272	388,908	162,045
6 x 8	9-1/8"	27.124	136,000	2,951,135	160,837	147,557	184,446	206,579	221,335	231,664	295,114	442,670	184,446

TORQUE GUIDE FOR ISO **R898** GRADE **10.9** STUD					**REQUIRED TORQUE** (FtLbs)								
BOLT TENSION BASED ON			90	**PERCENT YIELD**									
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	136,000	40,917	279	256	320	358	384	401	511	767	320
7/8 x 9	1-7/16"	0.461	136,000	56,487	449	412	515	577	618	647	824	1,236	515
1x 8	1-5/8"	0.605	136,000	74,105	673	618	772	865	926	970	1,235	1,853	772
1-1/8 x 8	1-13/16"	0.790	136,000	96,702	988	907	1,133	1,269	1,360	1,423	1,813	2,720	1,133
1-1/4 x 8	2"	0.999	136,000	122,302	1,389	1,274	1,592	1,784	1,911	2,000	2,548	3,822	1,592
1-3/8 x 8	2-3/16"	1.233	136,000	150,904	1,885	1,729	2,161	2,421	2,594	2,715	3,458	5,187	2,161
1-1/2 x 8	2-3/8"	1.491	136,000	182,509	2,487	2,281	2,852	3,194	3,422	3,582	4,563	6,844	2,852
1-5/8 x 8	2-9/16"	1.774	136,000	217,116	3,205	2,940	3,675	4,116	4,410	4,616	5,880	8,820	3,675
1-3/4 x 8	2-3/4"	2.081	136,000	254,726	4,049	3,715	4,643	5,201	5,572	5,832	7,430	11,144	4,643
1-7/8 x 8	2-15/16"	2.413	136,000	295,339	5,030	4,615	5,768	6,461	6,922	7,245	9,229	13,844	5,768
2 x 8	3-1/8"	2.769	136,000	338,954	6,158	5,649	7,062	7,909	8,474	8,869	11,298	16,948	7,062
2-1/8 x 8	3-5/16"	3.150	136,000	385,572	7,442	6,828	8,535	9,559	10,242	10,720	13,656	20,483	8,535
2-1/4 x 8	3-1/2"	3.555	136,000	435,192	8,894	8,160	10,200	11,424	12,240	12,811	16,320	24,480	10,200
2-3/8 x 8	3-11/16"	3.985	136,000	487,815	10,524	9,655	12,068	13,517	14,482	15,158	19,309	28,964	12,068
2-1/2 x 8	3-7/8"	4.440	136,000	543,441	12,341	11,322	14,152	15,850	16,983	17,775	22,643	33,965	14,152
2-3/4 x 8	4-1/4"	5.422	136,000	663,700	16,579	15,210	19,012	21,294	22,815	23,879	30,420	45,629	19,012
3 x 8	4-5/8"	6.503	136,000	795,970	21,690	19,899	24,874	27,859	29,849	31,242	39,799	59,698	24,874
3-1/4 x 8	5"	7.682	136,000	940,250	27,757	25,465	31,831	35,651	38,198	39,980	50,930	76,395	31,831
3-1/2 x 8	5-3/8"	8.959	136,000	1,096,541	34,861	31,982	39,978	44,775	47,974	50,212	63,965	95,947	39,978
3-3/4 x 8	5-3/4"	10.334	136,000	1,264,843	43,084	39,526	49,408	55,337	59,289	62,056	79,053	118,579	49,408
4 x 8	6-1/8"	11.807	136,000	1,445,154	52,507	48,172	60,215	67,441	72,258	75,630	96,344	144,515	60,215
4-1/4 x 8	6-1/2"	13.378	136,000	1,637,477	63,213	57,994	72,492	81,192	86,991	91,051	115,988	173,982	72,492
4-1/2 x 8	6-7/8"	15.047	136,000	1,841,810	75,284	69,068	86,335	96,695	103,602	108,437	138,136	207,204	86,335
4-3/4 x 8	7-1/4"	16.815	136,000	2,058,153	88,801	81,469	101,836	114,056	122,203	127,906	162,937	244,406	101,836
5 x 8	7-5/8"	18.681	136,000	2,286,507	103,846	95,271	119,089	133,380	142,907	149,576	190,542	285,813	119,089
5-1/4 x 8	8"	20.644	136,000	2,526,871	120,500	110,551	138,188	154,771	165,826	173,564	221,101	331,652	138,188
5-1/2 x 8	8-3/8"	22.706	136,000	2,779,246	138,846	127,382	159,228	178,335	191,073	199,990	254,764	382,146	159,228
5-3/4 x 8	8-3/4"	24.866	136,000	3,043,631	158,966	145,841	182,301	204,177	218,761	228,970	291,681	437,522	182,301
6 x 8	9-1/8"	27.124	136,000	3,320,027	180,941	166,001	207,502	232,402	249,002	260,622	332,003	498,004	207,502

TORQUE GUIDE FOR ISO **R898** GRADE **10.9** STUD					**REQUIRED TORQUE** (FtLbs)								
BOLT TENSION BASED ON			99	**PERCENT YIELD**									
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	136,000	45,009	307	281	352	394	422	442	563	844	352
7/8 x 9	1-7/16"	0.461	136,000	62,136	494	453	566	634	680	711	906	1,359	566
1x 8	1-5/8"	0.605	136,000	81,516	740	679	849	951	1,019	1,067	1,359	2,038	849
1-1/8 x 8	1-13/16"	0.790	136,000	106,373	1,087	997	1,247	1,396	1,496	1,566	1,994	2,992	1,247
1-1/4 x 8	2"	0.999	136,000	134,532	1,527	1,401	1,752	1,962	2,102	2,200	2,803	4,204	1,752
1-3/8 x 8	2-3/16"	1.233	136,000	165,994	2,073	1,902	2,378	2,663	2,853	2,986	3,804	5,706	2,378
1-1/2 x 8	2-3/8"	1.491	136,000	200,760	2,735	2,509	3,137	3,513	3,764	3,940	5,019	7,528	3,137
1-5/8 x 8	2-9/16"	1.774	136,000	238,828	3,525	3,234	4,043	4,528	4,851	5,078	6,468	9,702	4,043
1-3/4 x 8	2-3/4"	2.081	136,000	280,199	4,454	4,086	5,108	5,721	6,129	6,415	8,172	12,259	5,108
1-7/8 x 8	2-15/16"	2.413	136,000	324,872	5,533	5,076	6,345	7,107	7,614	7,970	10,152	15,228	6,345
2 x 8	3-1/8"	2.769	136,000	372,849	6,773	6,214	7,768	8,700	9,321	9,756	12,428	18,642	7,768
2-1/8 x 8	3-5/16"	3.150	136,000	424,129	8,187	7,511	9,388	10,515	11,266	11,792	15,021	22,532	9,388
2-1/4 x 8	3-1/2"	3.555	136,000	478,711	9,784	8,976	11,220	12,566	13,464	14,092	17,952	26,928	11,220
2-3/8 x 8	3-11/16"	3.985	136,000	536,597	11,576	10,620	13,275	14,868	15,930	16,674	21,240	31,860	13,275
2-1/2 x 8	3-7/8"	4.440	136,000	597,785	13,575	12,454	15,567	17,435	18,681	19,553	24,908	37,362	15,567
2-3/4 x 8	4-1/4"	5.422	136,000	730,070	18,237	16,731	20,913	23,423	25,096	26,267	33,462	50,192	20,913
3 x 8	4-5/8"	6.503	136,000	875,567	23,859	21,889	27,361	30,645	32,834	34,366	43,778	65,668	27,361
3-1/4 x 8	5"	7.682	136,000	1,034,276	30,533	28,012	35,015	39,216	42,017	43,978	56,023	84,035	35,015
3-1/2 x 8	5-3/8"	8.959	136,000	1,206,195	38,347	35,181	43,976	49,253	52,771	55,234	70,361	105,542	43,976
3-3/4 x 8	5-3/4"	10.334	136,000	1,391,327	47,392	43,479	54,349	60,871	65,218	68,262	86,958	130,437	54,349
4 x 8	6-1/8"	11.807	136,000	1,589,670	57,758	52,989	66,236	74,185	79,483	83,193	105,978	158,967	66,236
4-1/4 x 8	6-1/2"	13.378	136,000	1,801,225	69,535	63,793	79,742	89,311	95,690	100,156	127,587	191,380	79,742
4-1/2 x 8	6-7/8"	15.047	136,000	2,025,991	82,812	75,975	94,968	106,365	113,962	119,280	151,949	227,924	94,968
4-3/4 x 8	7-1/4"	16.815	136,000	2,263,968	97,681	89,615	112,019	125,462	134,423	140,696	179,231	268,846	112,019
5 x 8	7-5/8"	18.681	136,000	2,515,158	114,230	104,798	130,998	146,718	157,197	164,533	209,596	314,395	130,998
5-1/4 x 8	8"	20.644	136,000	2,779,558	132,550	121,606	152,007	170,248	182,409	190,921	243,211	364,817	152,007
5-1/2 x 8	8-3/8"	22.706	136,000	3,057,171	152,731	140,120	175,150	196,168	210,180	219,989	280,241	420,361	175,150
5-3/4 x 8	8-3/4"	24.866	136,000	3,347,994	174,863	160,425	200,531	224,595	240,637	251,867	320,849	481,274	200,531
6 x 8	9-1/8"	27.124	136,000	3,652,030	199,036	182,601	228,252	255,642	273,902	286,684	365,203	547,804	228,252

BOLT LOAD IMPERIAL (GRADE 12.9)
40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR ISO **R898** GRADE **12.9** STUD
BOLT TENSION BASED ON 40 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	160,000	21,395	146	134	167	187	201	210	267	401	167
7/8 x 9	1-7/16"	0.461	160,000	29,536	235	215	269	302	323	338	431	646	269
1x 8	1-5/8"	0.605	160,000	38,748	352	323	404	452	484	507	646	969	404
1-1/8 x 8	1-13/16"	0.790	160,000	50,563	517	474	593	664	711	744	948	1,422	593
1-1/4 x 8	2"	0.999	160,000	63,949	726	666	833	933	999	1,046	1,332	1,998	833
1-3/8 x 8	2-3/16"	1.233	160,000	78,904	985	904	1,130	1,266	1,356	1,419	1,808	2,712	1,130
1-1/2 x 8	2-3/8"	1.491	160,000	95,429	1,300	1,193	1,491	1,670	1,789	1,873	2,386	3,579	1,491
1-5/8 x 8	2-9/16"	1.774	160,000	113,525	1,676	1,537	1,922	2,152	2,306	2,414	3,075	4,612	1,922
1-3/4 x 8	2-3/4"	2.081	160,000	133,190	2,117	1,942	2,428	2,719	2,914	3,049	3,885	5,827	2,428
1-7/8 x 8	2-15/16"	2.413	160,000	154,425	2,630	2,413	3,016	3,378	3,619	3,788	4,826	7,239	3,016
2 x 8	3-1/8"	2.769	160,000	177,231	3,220	2,954	3,692	4,135	4,431	4,638	5,908	8,862	3,692
2-1/8 x 8	3-5/16"	3.150	160,000	201,606	3,891	3,570	4,463	4,998	5,355	5,605	7,140	10,710	4,463
2-1/4 x 8	3-1/2"	3.555	160,000	227,551	4,651	4,267	5,333	5,973	6,400	6,699	8,533	12,800	5,333
2-3/8 x 8	3-11/16"	3.985	160,000	255,067	5,503	5,048	6,310	7,067	7,572	7,926	10,096	15,145	6,310
2-1/2 x 8	3-7/8"	4.440	160,000	284,152	6,453	5,920	7,400	8,288	8,880	9,294	11,840	17,760	7,400
2-3/4 x 8	4-1/4"	5.422	160,000	347,033	8,669	7,953	9,941	11,134	11,929	12,486	15,906	23,859	9,941
3 x 8	4-5/8"	6.503	160,000	416,194	11,341	10,405	13,006	14,567	15,607	16,336	20,810	31,215	13,006
3-1/4 x 8	5"	7.682	160,000	491,634	14,513	13,315	16,644	18,641	19,973	20,905	26,630	39,945	16,644
3-1/2 x 8	5-3/8"	8.959	160,000	573,355	18,228	16,723	20,904	23,412	25,084	26,255	33,446	50,169	20,904
3-3/4 x 8	5-3/4"	10.334	160,000	661,356	22,527	20,667	25,834	28,934	31,001	32,448	41,335	62,002	25,834
4 x 8	6-1/8"	11.807	160,000	755,636	27,455	25,188	31,485	35,263	37,782	39,545	50,376	75,564	31,485
4-1/4 x 8	6-1/2"	13.378	160,000	856,197	33,053	30,324	37,905	42,453	45,485	47,608	60,647	90,971	37,905
4-1/2 x 8	6-7/8"	15.047	160,000	963,038	39,364	36,114	45,142	50,559	54,171	56,699	72,228	108,342	45,142
4-3/4 x 8	7-1/4"	16.815	160,000	1,076,158	46,432	42,598	53,247	59,637	63,897	66,879	85,196	127,794	53,247
5 x 8	7-5/8"	18.681	160,000	1,195,559	54,298	49,815	62,269	69,741	74,722	78,209	99,630	149,445	62,269
5-1/4 x 8	8"	20.644	160,000	1,321,240	63,007	57,804	72,255	80,926	86,706	90,753	115,608	173,413	72,255
5-1/2 x 8	8-3/8"	22.706	160,000	1,453,201	72,599	66,605	83,256	93,247	99,908	104,570	133,210	199,815	83,256
5-3/4 x 8	8-3/4"	24.866	160,000	1,591,441	83,120	76,257	95,321	106,759	114,385	119,723	152,513	228,770	95,321
6 x 8	9-1/8"	27.124	160,000	1,735,962	94,610	86,798	108,498	121,517	130,197	136,273	173,596	260,394	108,498

TORQUE GUIDE FOR ISO **R898** GRADE **12.9** STUD

BOLT TENSION BASED ON 50 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	160,000	26,743	182	167	209	234	251	262	334	501	209
7/8 x 9	1-7/16"	0.461	160,000	36,920	293	269	337	377	404	423	538	808	337
1x 8	1-5/8"	0.605	160,000	48,435	440	404	505	565	605	634	807	1,211	505
1-1/8 x 8	1-13/16"	0.790	160,000	63,204	646	593	741	830	889	930	1,185	1,778	741
1-1/4 x 8	2"	0.999	160,000	79,936	908	833	1,041	1,166	1,249	1,307	1,665	2,498	1,041
1-3/8 x 8	2-3/16"	1.233	160,000	98,630	1,232	1,130	1,413	1,582	1,695	1,774	2,260	3,390	1,413
1-1/2 x 8	2-3/8"	1.491	160,000	119,287	1,625	1,491	1,864	2,088	2,237	2,341	2,982	4,473	1,864
1-5/8 x 8	2-9/16"	1.774	160,000	141,906	2,095	1,922	2,402	2,690	2,882	3,017	3,843	5,765	2,402
1-3/4 x 8	2-3/4"	2.081	160,000	166,488	2,646	2,428	3,035	3,399	3,642	3,812	4,856	7,284	3,035
1-7/8 x 8	2-15/16"	2.413	160,000	193,032	3,288	3,016	3,770	4,223	4,524	4,735	6,032	9,048	3,770
2 x 8	3-1/8"	2.769	160,000	221,538	4,025	3,692	4,615	5,169	5,538	5,797	7,385	11,077	4,615
2-1/8 x 8	3-5/16"	3.150	160,000	252,008	4,864	4,463	5,578	6,248	6,694	7,006	8,925	13,388	5,578
2-1/4 x 8	3-1/2"	3.555	160,000	284,439	5,813	5,333	6,667	7,467	8,000	8,373	10,666	16,000	6,667
2-3/8 x 8	3-11/16"	3.985	160,000	318,834	6,878	6,310	7,888	8,834	9,465	9,907	12,620	18,931	7,888
2-1/2 x 8	3-7/8"	4.440	160,000	355,190	8,066	7,400	9,250	10,360	11,100	11,618	14,800	22,199	9,250
2-3/4 x 8	4-1/4"	5.422	160,000	433,791	10,836	9,941	12,426	13,917	14,912	15,607	19,882	29,823	12,426
3 x 8	4-5/8"	6.503	160,000	520,242	14,177	13,006	16,258	18,208	19,509	20,419	26,012	39,018	16,258
3-1/4 x 8	5"	7.682	160,000	614,543	18,142	16,644	20,805	23,301	24,966	26,131	33,288	49,932	20,805
3-1/2 x 8	5-3/8"	8.959	160,000	716,694	22,785	20,904	26,129	29,265	31,355	32,819	41,807	62,711	26,129
3-3/4 x 8	5-3/4"	10.334	160,000	826,695	28,159	25,834	32,293	36,168	38,751	40,560	51,668	77,503	32,293
4 x 8	6-1/8"	11.807	160,000	944,545	34,318	31,485	39,356	44,079	47,227	49,431	62,970	94,455	39,356
4-1/4 x 8	6-1/2"	13.378	160,000	1,070,246	41,316	37,905	47,381	53,066	56,857	59,510	75,809	113,714	47,381
4-1/2 x 8	6-7/8"	15.047	160,000	1,203,797	49,205	45,142	56,428	63,199	67,714	70,874	90,285	135,427	56,428
4-3/4 x 8	7-1/4"	16.815	160,000	1,345,198	58,040	53,247	66,559	74,546	79,871	83,598	106,495	159,742	66,559
5 x 8	7-5/8"	18.681	160,000	1,494,449	67,873	62,269	77,836	87,176	93,403	97,762	124,537	186,806	77,836
5-1/4 x 8	8"	20.644	160,000	1,651,550	78,758	72,255	90,319	101,157	108,383	113,441	144,511	216,766	90,319
5-1/2 x 8	8-3/8"	22.706	160,000	1,816,501	90,749	83,256	104,070	116,559	124,884	130,712	166,513	249,769	104,070
5-3/4 x 8	8-3/4"	24.866	160,000	1,989,302	103,900	95,321	119,151	133,449	142,981	149,653	190,641	285,962	119,151
6 x 8	9-1/8"	27.124	160,000	2,169,952	118,262	108,498	135,622	151,897	162,746	170,341	216,995	325,493	135,622

TORQUE GUIDE FOR ISO **R898** GRADE **12.9** STUD

BOLT TENSION BASED ON 60 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	160,000	32,092	219	201	251	281	301	315	401	602	251
7/8 x 9	1-7/16"	0.461	160,000	44,304	352	323	404	452	485	507	646	969	404
1x 8	1-5/8"	0.605	160,000	58,122	528	484	605	678	727	760	969	1,453	605
1-1/8 x 8	1-13/16"	0.790	160,000	75,845	775	711	889	995	1,067	1,116	1,422	2,133	889
1-1/4 x 8	2"	0.999	160,000	95,923	1,089	999	1,249	1,399	1,499	1,569	1,998	2,998	1,249
1-3/8 x 8	2-3/16"	1.233	160,000	118,356	1,478	1,356	1,695	1,899	2,034	2,129	2,712	4,068	1,695
1-1/2 x 8	2-3/8"	1.491	160,000	143,144	1,950	1,789	2,237	2,505	2,684	2,809	3,579	5,368	2,237
1-5/8 x 8	2-9/16"	1.774	160,000	170,287	2,514	2,306	2,882	3,228	3,459	3,620	4,612	6,918	2,882
1-3/4 x 8	2-3/4"	2.081	160,000	199,785	3,176	2,914	3,642	4,079	4,370	4,574	5,827	8,741	3,642
1-7/8 x 8	2-15/16"	2.413	160,000	231,638	3,945	3,619	4,524	5,067	5,429	5,682	7,239	10,858	4,524
2 x 8	3-1/8"	2.769	160,000	265,846	4,830	4,431	5,538	6,203	6,646	6,956	8,862	13,292	5,538
2-1/8 x 8	3-5/16"	3.150	160,000	302,409	5,837	5,355	6,694	7,497	8,033	8,408	10,710	16,065	6,694
2-1/4 x 8	3-1/2"	3.555	160,000	341,327	6,976	6,400	8,000	8,960	9,600	10,048	12,800	19,200	8,000
2-3/8 x 8	3-11/16"	3.985	160,000	382,600	8,254	7,572	9,465	10,601	11,358	11,889	15,145	22,717	9,465
2-1/2 x 8	3-7/8"	4.440	160,000	426,228	9,679	8,880	11,100	12,432	13,320	13,941	17,760	26,639	11,100
2-3/4 x 8	4-1/4"	5.422	160,000	520,549	13,003	11,929	14,912	16,701	17,894	18,729	23,859	35,788	14,912
3 x 8	4-5/8"	6.503	160,000	624,290	17,012	15,607	19,509	21,850	23,411	24,503	31,215	46,822	19,509
3-1/4 x 8	5"	7.682	160,000	737,451	21,770	19,973	24,966	27,962	29,959	31,357	39,945	59,918	24,966
3-1/2 x 8	5-3/8"	8.959	160,000	860,032	27,342	25,084	31,355	35,118	37,626	39,382	50,169	75,253	31,355
3-3/4 x 8	5-3/4"	10.334	160,000	992,033	33,791	31,001	38,751	43,401	46,502	48,672	62,002	93,003	38,751
4 x 8	6-1/8"	11.807	160,000	1,133,455	41,182	37,782	47,227	52,895	56,673	59,317	75,564	113,345	47,227
4-1/4 x 8	6-1/2"	13.378	160,000	1,284,296	49,579	45,485	56,857	63,680	68,228	71,412	90,971	136,456	56,857
4-1/2 x 8	6-7/8"	15.047	160,000	1,444,557	59,046	54,171	67,714	75,839	81,256	85,048	108,342	162,513	67,714
4-3/4 x 8	7-1/4"	16.815	160,000	1,614,238	69,648	63,897	79,871	89,456	95,845	100,318	127,794	191,691	79,871
5 x 8	7-5/8"	18.681	160,000	1,793,339	81,447	74,722	93,403	104,611	112,084	117,314	149,445	224,167	93,403
5-1/4 x 8	8"	20.644	160,000	1,981,860	94,510	86,706	108,383	121,389	130,060	136,129	173,413	260,119	108,383
5-1/2 x 8	8-3/8"	22.706	160,000	2,179,801	108,899	99,908	124,884	139,871	149,861	156,855	199,815	299,723	124,884
5-3/4 x 8	8-3/4"	24.866	160,000	2,387,162	124,679	114,385	142,981	160,139	171,577	179,584	228,770	343,155	142,981
6 x 8	9-1/8"	27.124	160,000	2,603,943	141,915	130,197	162,746	182,276	195,296	204,410	260,394	390,591	162,746

TORQUE GUIDE FOR ISO **R898** GRADE **12.9** STUD					REQUIRED TORQUE (FtLbs)								
BOLT TENSION BASED ON			70	PERCENT YIELD									
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	160,000	37,441	255	234	293	328	351	367	468	702	293
7/8 x 9	1-7/16"	0.461	160,000	51,688	411	377	471	528	565	592	754	1,131	471
1x 8	1-5/8"	0.605	160,000	67,809	616	565	706	791	848	887	1,130	1,695	706
1-1/8 x 8	1-13/16"	0.790	160,000	88,486	904	830	1,037	1,161	1,244	1,302	1,659	2,489	1,037
1-1/4 x 8	2"	0.999	160,000	111,910	1,271	1,166	1,457	1,632	1,749	1,830	2,331	3,497	1,457
1-3/8 x 8	2-3/16"	1.233	160,000	138,082	1,725	1,582	1,978	2,215	2,373	2,484	3,164	4,747	1,978
1-1/2 x 8	2-3/8"	1.491	160,000	167,001	2,275	2,088	2,609	2,923	3,131	3,277	4,175	6,263	2,609
1-5/8 x 8	2-9/16"	1.774	160,000	198,668	2,932	2,690	3,363	3,766	4,035	4,224	5,381	8,071	3,363
1-3/4 x 8	2-3/4"	2.081	160,000	233,083	3,705	3,399	4,249	4,759	5,099	5,337	6,798	10,197	4,249
1-7/8 x 8	2-15/16"	2.413	160,000	270,244	4,603	4,223	5,278	5,912	6,334	6,629	8,445	12,668	5,278
2 x 8	3-1/8"	2.769	160,000	310,154	5,634	5,169	6,462	7,237	7,754	8,116	10,338	15,508	6,462
2-1/8 x 8	3-5/16"	3.150	160,000	352,811	6,810	6,248	7,810	8,747	9,372	9,809	12,495	18,743	7,810
2-1/4 x 8	3-1/2"	3.555	160,000	398,215	8,139	7,467	9,333	10,453	11,200	11,722	14,933	22,400	9,333
2-3/8 x 8	3-11/16"	3.985	160,000	446,367	9,629	8,834	11,043	12,368	13,252	13,870	17,669	26,503	11,043
2-1/2 x 8	3-7/8"	4.440	160,000	497,266	11,292	10,360	12,950	14,504	15,540	16,265	20,719	31,079	12,950
2-3/4 x 8	4-1/4"	5.422	160,000	607,307	15,170	13,917	17,397	19,484	20,876	21,850	27,835	41,752	17,397
3 x 8	4-5/8"	6.503	160,000	728,339	19,847	18,208	22,761	25,492	27,313	28,587	36,417	54,625	22,761
3-1/4 x 8	5"	7.682	160,000	860,360	25,399	23,301	29,127	32,622	34,952	36,583	46,603	69,904	29,127
3-1/2 x 8	5-3/8"	8.959	160,000	1,003,371	31,899	29,265	36,581	40,971	43,897	45,946	58,530	87,795	36,581
3-3/4 x 8	5-3/4"	10.334	160,000	1,157,372	39,423	36,168	45,210	50,635	54,252	56,784	72,336	108,504	45,210
4 x 8	6-1/8"	11.807	160,000	1,322,364	48,046	44,079	55,098	61,710	66,118	69,204	88,158	132,236	55,098
4-1/4 x 8	6-1/2"	13.378	160,000	1,498,345	57,842	53,066	66,333	74,293	79,600	83,314	106,133	159,199	66,333
4-1/2 x 8	6-7/8"	15.047	160,000	1,685,316	68,887	63,199	78,999	88,479	94,799	99,223	126,399	189,598	78,999
4-3/4 x 8	7-1/4"	16.815	160,000	1,883,277	81,256	74,546	93,183	104,365	111,820	117,038	149,093	223,639	93,183
5 x 8	7-5/8"	18.681	160,000	2,092,228	95,022	87,176	108,970	122,047	130,764	136,867	174,352	261,529	108,970
5-1/4 x 8	8"	20.644	160,000	2,312,170	110,262	101,157	126,447	141,620	151,736	158,817	202,315	303,472	126,447
5-1/2 x 8	8-3/8"	22.706	160,000	2,543,101	127,049	116,559	145,698	163,182	174,838	182,997	233,118	349,676	145,698
5-3/4 x 8	8-3/4"	24.866	160,000	2,785,022	145,459	133,449	166,811	186,829	200,173	209,515	266,898	400,347	166,811
6 x 8	9-1/8"	27.124	160,000	3,037,933	165,567	151,897	189,871	212,655	227,845	238,478	303,793	455,690	189,871

TORQUE GUIDE FOR ISO **R898** GRADE **12.9** STUD					REQUIRED TORQUE (FtLbs)								
BOLT TENSION BASED ON			80	PERCENT YIELD									
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	160,000	42,789	292	267	334	374	401	420	535	802	334
7/8 x 9	1-7/16"	0.461	160,000	59,072	469	431	538	603	646	676	861	1,292	538
1x 8	1-5/8"	0.605	160,000	77,496	704	646	807	904	969	1,014	1,292	1,937	807
1-1/8 x 8	1-13/16"	0.790	160,000	101,127	1,033	948	1,185	1,327	1,422	1,488	1,896	2,844	1,185
1-1/4 x 8	2"	0.999	160,000	127,897	1,452	1,332	1,665	1,865	1,998	2,092	2,665	3,997	1,665
1-3/8 x 8	2-3/16"	1.233	160,000	157,808	1,971	1,808	2,260	2,532	2,712	2,839	3,616	5,425	2,260
1-1/2 x 8	2-3/8"	1.491	160,000	190,859	2,600	2,386	2,982	3,340	3,579	3,746	4,771	7,157	2,982
1-5/8 x 8	2-9/16"	1.774	160,000	227,049	3,351	3,075	3,843	4,304	4,612	4,827	6,149	9,224	3,843
1-3/4 x 8	2-3/4"	2.081	160,000	266,380	4,234	3,885	4,856	5,439	5,827	6,099	7,769	11,654	4,856
1-7/8 x 8	2-15/16"	2.413	160,000	308,851	5,260	4,826	6,032	6,756	7,239	7,576	9,652	14,477	6,032
2 x 8	3-1/8"	2.769	160,000	354,462	6,439	5,908	7,385	8,271	8,862	9,275	11,815	17,723	7,385
2-1/8 x 8	3-5/16"	3.150	160,000	403,212	7,783	7,140	8,925	9,996	10,710	11,210	14,280	21,421	8,925
2-1/4 x 8	3-1/2"	3.555	160,000	455,103	9,301	8,533	10,666	11,946	12,800	13,397	17,066	25,600	10,666
2-3/8 x 8	3-11/16"	3.985	160,000	510,134	11,005	10,096	12,620	14,135	15,145	15,851	20,193	30,289	12,620
2-1/2 x 8	3-7/8"	4.440	160,000	568,304	12,905	11,840	14,800	16,576	17,760	18,588	23,679	35,519	14,800
2-3/4 x 8	4-1/4"	5.422	160,000	694,066	17,337	15,906	19,882	22,268	23,859	24,972	31,811	47,717	19,882
3 x 8	4-5/8"	6.503	160,000	832,387	22,683	20,810	26,012	29,134	31,215	32,671	41,619	62,429	26,012
3-1/4 x 8	5"	7.682	160,000	983,268	29,027	26,630	33,288	37,282	39,945	41,809	53,260	79,891	33,288
3-1/2 x 8	5-3/8"	8.959	160,000	1,146,710	36,456	33,446	41,807	46,824	50,169	52,510	66,891	100,337	41,807
3-3/4 x 8	5-3/4"	10.334	160,000	1,322,711	45,055	41,335	51,668	57,869	62,002	64,896	82,669	124,004	51,668
4 x 8	6-1/8"	11.807	160,000	1,511,273	54,910	50,376	62,970	70,526	75,564	79,090	100,752	151,127	62,970
4-1/4 x 8	6-1/2"	13.378	160,000	1,712,394	66,106	60,647	75,809	84,906	90,971	95,216	121,295	181,942	75,809
4-1/2 x 8	6-7/8"	15.047	160,000	1,926,075	78,728	72,228	90,285	101,119	108,342	113,398	144,456	216,683	90,285
4-3/4 x 8	7-1/4"	16.815	160,000	2,152,317	92,864	85,196	106,495	119,274	127,794	133,758	170,392	255,588	106,495
5 x 8	7-5/8"	18.681	160,000	2,391,118	108,597	99,630	124,537	139,482	149,445	156,419	199,260	298,890	124,537
5-1/4 x 8	8"	20.644	160,000	2,642,480	126,013	115,608	144,511	161,852	173,413	181,505	231,217	346,825	144,511
5-1/2 x 8	8-3/8"	22.706	160,000	2,906,401	145,199	133,210	166,513	186,494	199,815	209,140	266,420	399,630	166,513
5-3/4 x 8	8-3/4"	24.866	160,000	3,182,882	166,239	152,513	190,641	213,518	228,770	239,446	305,026	457,539	190,641
6 x 8	9-1/8"	27.124	160,000	3,471,924	189,220	173,596	216,995	243,035	260,394	272,546	347,192	520,789	216,995

TORQUE GUIDE FOR ISO **R898** GRADE **12.9** STUD					**REQUIRED TORQUE** (FtLbs)								
BOLT TENSION BASED ON			90	**PERCENT YIELD**									
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN²)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	160,000	48,138	328	301	376	421	451	472	602	903	376
7/8 x 9	1-7/16"	0.461	160,000	66,456	528	485	606	678	727	761	969	1,454	606
1x 8	1-5/8"	0.605	160,000	87,183	792	727	908	1,017	1,090	1,141	1,453	2,180	908
1-1/8 x 8	1-13/16"	0.790	160,000	113,767	1,163	1,067	1,333	1,493	1,600	1,675	2,133	3,200	1,333
1-1/4 x 8	2"	0.999	160,000	143,884	1,634	1,499	1,873	2,098	2,248	2,353	2,998	4,496	1,873
1-3/8 x 8	2-3/16"	1.233	160,000	177,534	2,217	2,034	2,543	2,848	3,051	3,194	4,068	6,103	2,543
1-1/2 x 8	2-3/8"	1.491	160,000	214,716	2,926	2,684	3,355	3,758	4,026	4,214	5,368	8,052	3,355
1-5/8 x 8	2-9/16"	1.774	160,000	255,431	3,770	3,459	4,324	4,843	5,188	5,431	6,918	10,377	4,324
1-3/4 x 8	2-3/4"	2.081	160,000	299,678	4,764	4,370	5,463	6,118	6,555	6,861	8,741	13,111	5,463
1-7/8 x 8	2-15/16"	2.413	160,000	347,457	5,918	5,429	6,786	7,601	8,144	8,524	10,858	16,287	6,786
2 x 8	3-1/8"	2.769	160,000	398,769	7,244	6,646	8,308	9,305	9,969	10,434	13,292	19,938	8,308
2-1/8 x 8	3-5/16"	3.150	160,000	453,614	8,756	8,033	10,041	11,246	12,049	12,611	16,065	24,098	10,041
2-1/4 x 8	3-1/2"	3.555	160,000	511,991	10,464	9,600	12,000	13,440	14,400	15,072	19,200	28,799	12,000
2-3/8 x 8	3-11/16"	3.985	160,000	573,900	12,381	11,358	14,198	15,902	17,038	17,833	22,717	34,075	14,198
2-1/2 x 8	3-7/8"	4.440	160,000	639,342	14,518	13,320	16,650	18,647	19,979	20,912	26,639	39,959	16,650
2-3/4 x 8	4-1/4"	5.422	160,000	780,824	19,504	17,894	22,367	25,051	26,841	28,093	35,788	53,682	22,367
3 x 8	4-5/8"	6.503	160,000	936,435	25,518	23,411	29,264	32,775	35,116	36,755	46,822	70,233	29,264
3-1/4 x 8	5"	7.682	160,000	1,106,177	32,655	29,959	37,449	41,943	44,938	47,036	59,918	89,877	37,449
3-1/2 x 8	5-3/8"	8.959	160,000	1,290,049	41,013	37,626	47,033	52,677	56,440	59,073	75,253	112,879	47,033
3-3/4 x 8	5-3/4"	10.334	160,000	1,488,050	50,687	46,502	58,127	65,102	69,752	73,007	93,003	139,505	58,127
4 x 8	6-1/8"	11.807	160,000	1,700,182	61,773	56,673	70,841	79,342	85,009	88,976	113,345	170,018	70,841
4-1/4 x 8	6-1/2"	13.378	160,000	1,926,443	74,369	68,228	85,285	95,519	102,342	107,118	136,456	204,685	85,285
4-1/2 x 8	6-7/8"	15.047	160,000	2,166,835	88,569	81,256	101,570	113,759	121,884	127,572	162,513	243,769	101,570
4-3/4 x 8	7-1/4"	16.815	160,000	2,421,356	104,471	95,845	119,807	134,184	143,768	150,477	191,691	287,536	119,807
5 x 8	7-5/8"	18.681	160,000	2,690,008	122,171	112,084	140,105	156,917	168,126	175,971	224,167	336,251	140,105
5-1/4 x 8	8"	20.644	160,000	2,972,790	141,765	130,060	162,574	182,083	195,089	204,193	260,119	390,179	162,574
5-1/2 x 8	8-3/8"	22.706	160,000	3,269,701	163,349	149,861	187,327	209,806	224,792	235,282	299,723	449,584	187,327
5-3/4 x 8	8-3/4"	24.866	160,000	3,580,743	187,019	171,577	214,472	240,208	257,366	269,376	343,155	514,732	214,472
6 x 8	9-1/8"	27.124	160,000	3,905,914	212,872	195,296	244,120	273,414	292,944	306,614	390,591	585,887	244,120

TORQUE GUIDE FOR ISO **R898** GRADE **12.9** STUD					**REQUIRED TORQUE** (FtLbs)								
BOLT TENSION BASED ON			99	**PERCENT YIELD**									
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN²)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.125
3/4 x 10	1-1/4"	0.334	160,000	52,952	361	331	414	463	496	520	662	993	414
7/8 x 9	1-7/16"	0.461	160,000	73,101	581	533	666	746	800	837	1,066	1,599	666
1x 8	1-5/8"	0.605	160,000	95,901	871	799	999	1,119	1,199	1,255	1,598	2,398	999
1-1/8 x 8	1-13/16"	0.790	160,000	125,144	1,279	1,173	1,467	1,643	1,760	1,842	2,346	3,520	1,467
1-1/4 x 8	2"	0.999	160,000	158,273	1,797	1,649	2,061	2,308	2,473	2,588	3,297	4,946	2,061
1-3/8 x 8	2-3/16"	1.233	160,000	195,287	2,439	2,238	2,797	3,133	3,357	3,513	4,475	6,713	2,797
1-1/2 x 8	2-3/8"	1.491	160,000	236,188	3,218	2,952	3,690	4,133	4,429	4,635	5,905	8,857	3,690
1-5/8 x 8	2-9/16"	1.774	160,000	280,974	4,147	3,805	4,756	5,327	5,707	5,974	7,610	11,415	4,756
1-3/4 x 8	2-3/4"	2.081	160,000	329,645	5,240	4,807	6,009	6,730	7,211	7,548	9,615	14,422	6,009
1-7/8 x 8	2-15/16"	2.413	160,000	382,203	6,509	5,972	7,465	8,361	8,958	9,376	11,944	17,916	7,465
2 x 8	3-1/8"	2.769	160,000	438,646	7,969	7,311	9,138	10,235	10,966	11,478	14,622	21,932	9,138
2-1/8 x 8	3-5/16"	3.150	160,000	498,975	9,631	8,836	11,045	12,370	13,254	13,873	17,672	26,508	11,045
2-1/4 x 8	3-1/2"	3.555	160,000	563,190	11,510	10,560	13,200	14,784	15,840	16,579	21,120	31,679	13,200
2-3/8 x 8	3-11/16"	3.985	160,000	631,290	13,619	12,494	15,618	17,492	18,741	19,616	24,989	37,483	15,618
2-1/2 x 8	3-7/8"	4.440	160,000	703,277	15,970	14,652	18,314	20,512	21,977	23,003	29,303	43,955	18,314
2-3/4 x 8	4-1/4"	5.422	160,000	858,906	21,455	19,683	24,604	27,557	29,525	30,903	39,367	59,050	24,604
3 x 8	4-5/8"	6.503	160,000	1,030,079	28,070	25,752	32,190	36,053	38,628	40,431	51,504	77,256	32,190
3-1/4 x 8	5"	7.682	160,000	1,216,795	35,921	32,955	41,194	46,137	49,432	51,739	65,910	98,865	41,194
3-1/2 x 8	5-3/8"	8.959	160,000	1,419,053	45,114	41,389	51,736	57,945	62,084	64,981	82,778	124,167	51,736
3-3/4 x 8	5-3/4"	10.334	160,000	1,636,855	55,755	51,152	63,940	71,612	76,728	80,308	102,303	153,455	63,940
4 x 8	6-1/8"	11.807	160,000	1,870,200	67,951	62,340	77,925	87,276	93,510	97,874	124,680	187,020	77,925
4-1/4 x 8	6-1/2"	13.378	160,000	2,119,088	81,806	75,051	93,814	105,071	112,577	117,830	150,102	225,153	93,814
4-1/2 x 8	6-7/8"	15.047	160,000	2,383,518	97,426	89,382	111,727	125,135	134,073	140,330	178,764	268,146	111,727
4-3/4 x 8	7-1/4"	16.815	160,000	2,663,492	114,919	105,430	131,787	147,602	158,145	165,525	210,860	316,290	131,787
5 x 8	7-5/8"	18.681	160,000	2,959,009	134,388	123,292	154,115	172,609	184,938	193,568	246,584	369,876	154,115
5-1/4 x 8	8"	20.644	160,000	3,270,069	155,941	143,066	178,832	200,292	214,598	224,613	286,131	429,197	178,832
5-1/2 x 8	8-3/8"	22.706	160,000	3,596,671	179,684	164,847	206,059	230,786	247,271	258,810	329,695	494,542	206,059
5-3/4 x 8	8-3/4"	24.866	160,000	3,938,817	205,721	188,735	235,919	264,229	283,102	296,314	377,470	566,205	235,919
6 x 8	9-1/8"	27.124	160,000	4,296,506	234,160	214,825	268,532	300,755	322,238	337,276	429,651	644,476	268,532

BOLT LOAD IMPERIAL (GRADE L7)
40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR ASTM **A320** GRADE **L7**

BOLT TENSION BASED ON 40 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE	API SA2	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.109
3/4 x 10	1-1/4"	0.334	105,000	14,040	96	88	110	123	132	138	176	263	96
7/8 x 9	1-7/16"	0.461	105,000	19,383	154	141	177	198	212	222	283	424	154
1x 8	1-5/8"	0.605	105,000	25,428	231	212	265	297	318	333	424	636	231
1-1/8 x 8	1-13/16"	0.790	105,000	33,182	339	311	389	436	467	488	622	933	339
1-1/4 x 8	2"	0.999	105,000	41,966	476	437	546	612	656	686	874	1,311	476
1-3/8 x 8	2-3/16"	1.233	105,000	51,781	647	593	742	831	890	932	1,187	1,780	647
1-1/2 x 8	2-3/8"	1.491	105,000	62,626	853	783	979	1,096	1,174	1,229	1,566	2,348	853
1-5/8 x 8	2-9/16"	1.774	105,000	74,501	1,100	1,009	1,261	1,412	1,513	1,584	2,018	3,027	1,100
1-3/4 x 8	2-3/4"	2.081	105,000	87,406	1,389	1,275	1,593	1,785	1,912	2,001	2,549	3,824	1,389
1-7/8 x 8	2-15/16"	2.413	105,000	101,342	1,726	1,583	1,979	2,217	2,375	2,486	3,167	4,750	1,726
2 x 8	3-1/8"	2.769	105,000	116,308	2,113	1,938	2,423	2,714	2,908	3,043	3,877	5,815	2,113
2-1/8 x 8	3-5/16"	3.150	105,000	132,304	2,554	2,343	2,929	3,280	3,514	3,678	4,686	7,029	2,554
2-1/4 x 8	3-1/2"	3.555	105,000	149,331	3,052	2,800	3,500	3,920	4,200	4,396	5,600	8,400	3,052
2-3/8 x 8	3-11/16"	3.985	105,000	167,388	3,611	3,313	4,141	4,638	4,969	5,201	6,626	9,939	3,611
2-1/2 x 8	3-7/8"	4.440	105,000	186,475	4,235	3,885	4,856	5,439	5,827	6,099	7,770	11,655	4,235

TORQUE GUIDE FOR ASTM **A320** GRADE **L7**

BOLT TENSION BASED ON 50 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE	API SA2	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.109
3/4 x 10	1-1/4"	0.334	105,000	17,550	120	110	137	154	165	172	219	329	120
7/8 x 9	1-7/16"	0.461	105,000	24,229	193	177	221	247	265	277	353	530	193
1x 8	1-5/8"	0.605	105,000	31,785	289	265	331	371	397	416	530	795	289
1-1/8 x 8	1-13/16"	0.790	105,000	41,478	424	389	486	544	583	611	778	1,167	424
1-1/4 x 8	2"	0.999	105,000	52,458	596	546	683	765	820	858	1,093	1,639	596
1-3/8 x 8	2-3/16"	1.233	105,000	64,726	808	742	927	1,038	1,112	1,164	1,483	2,225	808
1-1/2 x 8	2-3/8"	1.491	105,000	78,282	1,067	979	1,223	1,370	1,468	1,536	1,957	2,936	1,067
1-5/8 x 8	2-9/16"	1.774	105,000	93,126	1,375	1,261	1,576	1,766	1,892	1,980	2,522	3,783	1,375
1-3/4 x 8	2-3/4"	2.081	105,000	109,257	1,737	1,593	1,992	2,231	2,390	2,502	3,187	4,780	1,737
1-7/8 x 8	2-15/16"	2.413	105,000	126,677	2,157	1,979	2,474	2,771	2,969	3,108	3,959	5,938	2,157
2 x 8	3-1/8"	2.769	105,000	145,385	2,641	2,423	3,029	3,392	3,635	3,804	4,846	7,269	2,641
2-1/8 x 8	3-5/16"	3.150	105,000	165,380	3,192	2,929	3,661	4,100	4,393	4,598	5,857	8,786	3,192
2-1/4 x 8	3-1/2"	3.555	105,000	186,663	3,815	3,500	4,375	4,900	5,250	5,495	7,000	10,500	3,815
2-3/8 x 8	3-11/16"	3.985	105,000	209,234	4,514	4,141	5,176	5,798	6,212	6,502	8,282	12,423	4,514
2-1/2 x 8	3-7/8"	4.440	105,000	233,094	5,293	4,856	6,070	6,799	7,284	7,624	9,712	14,568	5,293

TORQUE GUIDE FOR ASTM **A320** GRADE **L7**

BOLT TENSION BASED ON 60 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE	API SA2	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.109
3/4 x 10	1-1/4"	0.334	105,000	21,060	143	132	165	184	197	207	263	395	143
7/8 x 9	1-7/16"	0.461	105,000	29,074	231	212	265	297	318	333	424	636	231
1x 8	1-5/8"	0.605	105,000	38,143	346	318	397	445	477	499	636	954	346
1-1/8 x 8	1-13/16"	0.790	105,000	49,773	509	467	583	653	700	733	933	1,400	509
1-1/4 x 8	2"	0.999	105,000	62,949	715	656	820	918	984	1,029	1,311	1,967	715
1-3/8 x 8	2-3/16"	1.233	105,000	77,671	970	890	1,112	1,246	1,335	1,397	1,780	2,670	970
1-1/2 x 8	2-3/8"	1.491	105,000	93,938	1,280	1,174	1,468	1,644	1,761	1,844	2,348	3,523	1,280
1-5/8 x 8	2-9/16"	1.774	105,000	111,751	1,649	1,513	1,892	2,119	2,270	2,376	3,027	4,540	1,649
1-3/4 x 8	2-3/4"	2.081	105,000	131,109	2,084	1,912	2,390	2,677	2,868	3,002	3,824	5,736	2,084
1-7/8 x 8	2-15/16"	2.413	105,000	152,013	2,589	2,375	2,969	3,325	3,563	3,729	4,750	7,126	2,589
2 x 8	3-1/8"	2.769	105,000	174,462	3,169	2,908	3,635	4,071	4,362	4,565	5,815	8,723	3,169
2-1/8 x 8	3-5/16"	3.150	105,000	198,456	3,831	3,514	4,393	4,920	5,271	5,517	7,029	10,543	3,831
2-1/4 x 8	3-1/2"	3.555	105,000	223,996	4,578	4,200	5,250	5,880	6,300	6,594	8,400	12,600	4,578
2-3/8 x 8	3-11/16"	3.985	105,000	251,081	5,417	4,969	6,212	6,957	7,454	7,802	9,939	14,908	5,417
2-1/2 x 8	3-7/8"	4.440	105,000	279,712	6,352	5,827	7,284	8,158	8,741	9,149	11,655	17,482	6,352

TORQUE GUIDE FOR ASTM **A320** GRADE **L7**

BOLT TENSION BASED ON 70 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE	API SA2	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.109
3/4 x 10	1-1/4"	0.334	105,000	24,570	167	154	192	215	230	241	307	461	167
7/8 x 9	1-7/16"	0.461	105,000	33,920	270	247	309	346	371	388	495	742	270
1x 8	1-5/8"	0.605	105,000	44,500	404	371	464	519	556	582	742	1,112	404
1-1/8 x 8	1-13/16"	0.790	105,000	58,069	593	544	680	762	817	855	1,089	1,633	593
1-1/4 x 8	2"	0.999	105,000	73,441	834	765	956	1,071	1,148	1,201	1,530	2,295	834
1-3/8 x 8	2-3/16"	1.233	105,000	90,616	1,132	1,038	1,298	1,454	1,557	1,630	2,077	3,115	1,132
1-1/2 x 8	2-3/8"	1.491	105,000	109,595	1,493	1,370	1,712	1,918	2,055	2,151	2,740	4,110	1,493
1-5/8 x 8	2-9/16"	1.774	105,000	130,376	1,924	1,766	2,207	2,472	2,648	2,772	3,531	5,297	1,924
1-3/4 x 8	2-3/4"	2.081	105,000	152,960	2,431	2,231	2,788	3,123	3,346	3,502	4,461	6,692	2,431
1-7/8 x 8	2-15/16"	2.413	105,000	177,348	3,020	2,771	3,464	3,879	4,157	4,351	5,542	8,313	3,020
2 x 8	3-1/8"	2.769	105,000	203,538	3,698	3,392	4,240	4,749	5,088	5,326	6,785	10,177	3,698
2-1/8 x 8	3-5/16"	3.150	105,000	231,532	4,469	4,100	5,125	5,740	6,150	6,437	8,200	12,300	4,469
2-1/4 x 8	3-1/2"	3.555	105,000	261,329	5,341	4,900	6,125	6,860	7,350	7,693	9,800	14,700	5,341
2-3/8 x 8	3-11/16"	3.985	105,000	292,928	6,319	5,798	7,247	8,117	8,696	9,102	11,595	17,393	6,319
2-1/2 x 8	3-7/8"	4.440	105,000	326,331	7,410	6,799	8,498	9,518	10,198	10,674	13,597	20,396	7,410

TORQUE GUIDE FOR ASTM **A320** GRADE **L7**

BOLT TENSION BASED ON 80 **PERCENT YIELD**

REQUIRED TORQUE (FtLbs)

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE	API SA2	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.109
3/4 x 10	1-1/4"	0.334	105,000	28,080	191	176	219	246	263	276	351	527	191
7/8 x 9	1-7/16"	0.461	105,000	38,766	308	283	353	396	424	444	565	848	308
1x 8	1-5/8"	0.605	105,000	50,857	462	424	530	593	636	665	848	1,271	462
1-1/8 x 8	1-13/16"	0.790	105,000	66,364	678	622	778	871	933	977	1,244	1,866	678
1-1/4 x 8	2"	0.999	105,000	83,933	953	874	1,093	1,224	1,311	1,373	1,749	2,623	953
1-3/8 x 8	2-3/16"	1.233	105,000	103,562	1,293	1,187	1,483	1,661	1,780	1,863	2,373	3,560	1,293
1-1/2 x 8	2-3/8"	1.491	105,000	125,251	1,707	1,566	1,957	2,192	2,348	2,458	3,131	4,697	1,707
1-5/8 x 8	2-9/16"	1.774	105,000	149,001	2,199	2,018	2,522	2,825	3,027	3,168	4,035	6,053	2,199
1-3/4 x 8	2-3/4"	2.081	105,000	174,812	2,779	2,549	3,187	3,569	3,824	4,002	5,099	7,648	2,779
1-7/8 x 8	2-15/16"	2.413	105,000	202,683	3,452	3,167	3,959	4,434	4,750	4,972	6,334	9,501	3,452
2 x 8	3-1/8"	2.769	105,000	232,615	4,226	3,877	4,846	5,428	5,815	6,087	7,754	11,631	4,226
2-1/8 x 8	3-5/16"	3.150	105,000	264,608	5,107	4,686	5,857	6,560	7,029	7,357	9,372	14,057	5,107
2-1/4 x 8	3-1/2"	3.555	105,000	298,661	6,104	5,600	7,000	7,840	8,400	8,792	11,200	16,800	6,104
2-3/8 x 8	3-11/16"	3.985	105,000	334,775	7,222	6,626	8,282	9,276	9,939	10,402	13,252	19,877	7,222
2-1/2 x 8	3-7/8"	4.440	105,000	372,950	8,469	7,770	9,712	10,878	11,655	12,199	15,540	23,309	8,469

TORQUE GUIDE FOR ASTM **A320** GRADE **L7**					**REQUIRED TORQUE** (FtLbs)								
BOLT TENSION BASED ON			90	**PERCENT YIELD**									
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE	API SA2	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.109
3/4 x 10	1-1/4"	0.334	105,000	31,590	215	197	247	276	296	310	395	592	215
7/8 x 9	1-7/16"	0.461	105,000	43,612	347	318	398	445	477	499	636	954	347
1x 8	1-5/8"	0.605	105,000	57,214	520	477	596	667	715	749	954	1,430	520
1-1/8 x 8	1-13/16"	0.790	105,000	74,660	763	700	875	980	1,050	1,099	1,400	2,100	763
1-1/4 x 8	2"	0.999	105,000	94,424	1,072	984	1,229	1,377	1,475	1,544	1,967	2,951	1,072
1-3/8 x 8	2-3/16"	1.233	105,000	116,507	1,455	1,335	1,669	1,869	2,002	2,096	2,670	4,005	1,455
1-1/2 x 8	2-3/8"	1.491	105,000	140,907	1,920	1,761	2,202	2,466	2,642	2,765	3,523	5,284	1,920
1-5/8 x 8	2-9/16"	1.774	105,000	167,626	2,474	2,270	2,837	3,178	3,405	3,564	4,540	6,810	2,474
1-3/4 x 8	2-3/4"	2.081	105,000	196,663	3,126	2,868	3,585	4,015	4,302	4,503	5,736	8,604	3,126
1-7/8 x 8	2-15/16"	2.413	105,000	228,019	3,883	3,563	4,453	4,988	5,344	5,594	7,126	10,688	3,883
2 x 8	3-1/8"	2.769	105,000	261,692	4,754	4,362	5,452	6,106	6,542	6,848	8,723	13,085	4,754
2-1/8 x 8	3-5/16"	3.150	105,000	297,684	5,746	5,271	6,589	7,380	7,907	8,276	10,543	15,814	5,746
2-1/4 x 8	3-1/2"	3.555	105,000	335,994	6,867	6,300	7,875	8,820	9,450	9,891	12,600	18,900	6,867
2-3/8 x 8	3-11/16"	3.985	105,000	376,622	8,125	7,454	9,317	10,436	11,181	11,703	14,908	22,362	8,125
2-1/2 x 8	3-7/8"	4.440	105,000	419,568	9,528	8,741	10,926	12,237	13,112	13,723	17,482	26,223	9,528

TORQUE GUIDE FOR ASTM **A320** GRADE **L7**					**REQUIRED TORQUE** (FtLbs)								
BOLT TENSION BASED ON			99	**PERCENT YIELD**									
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE	API SA2	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.109
3/4 x 10	1-1/4"	0.334	105,000	34,749	237	217	271	304	326	341	434	652	237
7/8 x 9	1-7/16"	0.461	105,000	47,973	381	350	437	490	525	549	700	1,049	381
1x 8	1-5/8"	0.605	105,000	62,935	572	524	656	734	787	823	1,049	1,573	572
1-1/8 x 8	1-13/16"	0.790	105,000	82,126	839	770	962	1,078	1,155	1,209	1,540	2,310	839
1-1/4 x 8	2"	0.999	105,000	103,867	1,179	1,082	1,352	1,515	1,623	1,699	2,164	3,246	1,179
1-3/8 x 8	2-3/16"	1.233	105,000	128,157	1,601	1,468	1,836	2,056	2,203	2,305	2,937	4,405	1,601
1-1/2 x 8	2-3/8"	1.491	105,000	154,998	2,112	1,937	2,422	2,712	2,906	3,042	3,875	5,812	2,112
1-5/8 x 8	2-9/16"	1.774	105,000	184,389	2,722	2,497	3,121	3,496	3,745	3,920	4,994	7,491	2,722
1-3/4 x 8	2-3/4"	2.081	105,000	216,330	3,439	3,155	3,944	4,417	4,732	4,953	6,310	9,464	3,439
1-7/8 x 8	2-15/16"	2.413	105,000	250,821	4,272	3,919	4,899	5,487	5,879	6,153	7,838	11,757	4,272
2 x 8	3-1/8"	2.769	105,000	287,862	5,229	4,798	5,997	6,717	7,197	7,532	9,595	14,393	5,229
2-1/8 x 8	3-5/16"	3.150	105,000	327,452	6,321	5,799	7,248	8,118	8,698	9,104	11,597	17,396	6,321
2-1/4 x 8	3-1/2"	3.555	105,000	369,593	7,554	6,930	8,662	9,702	10,395	10,880	13,860	20,790	7,554
2-3/8 x 8	3-11/16"	3.985	105,000	414,284	8,937	8,199	10,249	11,479	12,299	12,873	16,399	24,598	8,937
2-1/2 x 8	3-7/8"	4.440	105,000	461,525	10,480	9,615	12,019	13,461	14,423	15,096	19,230	28,845	10,480

BOLT LOAD (IMPERIAL) SOCKET HEAD CAP SCREWS B7

40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR **SOCKET HEAD CAP SCREWS (INCH)**

MATERI **ASTM A547** ALLOY STEEL

BOLT TENSION BASED ON **40** PERCENT YIELD

REQUIRED TORQUE (FtLbs)

BOLT SIZE	THREADS PER INCH	HEX A.F.	STRESS AREA $(in)^2$	MIN YIELD STRENGTH	BOLT TENSION	LoaDISC TS801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.20	DRY STEEL K=.440	CUSTOM INSERT 0.125
5/8	11	0.500	0.226	155,000	14,005	80	73	91	102	109	115	146	321	91
3/4	10	0.625	0.334	155,000	20,726	141	130	162	181	194	203	259	570	162
7/8	9	0.750	0.461	155,000	28,613	227	209	261	292	313	328	417	918	261
1	8	0.750	0.605	155,000	37,537	341	313	391	438	469	491	626	1,376	391
1 1/8	7	0.875	0.763	155,000	47,299	483	443	554	621	665	696	887	1,951	554
1 1/4	7	0.875	0.969	155,000	60,054	682	626	782	876	938	982	1,251	2,752	782
1 3/8	6	1.000	1.154	155,000	71,566	894	820	1,025	1,148	1,230	1,287	1,640	3,608	1,025
1 1/2	6	1.000	1.405	155,000	87,081	1,186	1,089	1,361	1,524	1,633	1,709	2,177	4,789	1,361
1 3/4	5	1.250	1.898	155,000	117,706	1,871	1,717	2,146	2,403	2,575	2,695	3,433	7,553	2,146
2	4.5	1.500	2.497	155,000	154,811	2,812	2,580	3,225	3,612	3,870	4,051	5,160	11,353	3,225
2 1/4	4.5	1.750	3.246	155,000	201,254	4,113	3,774	4,717	5,283	5,660	5,924	7,547	16,603	4,717
2 1/2	4	1.750	3.997	155,000	247,801	5,627	5,163	6,453	7,228	7,744	8,105	10,325	22,715	6,453
2 3/4	4	2.000	4.932	155,000	305,753	7,637	7,007	8,759	9,810	10,510	11,001	14,014	30,830	8,759
3	4	2.250	5.964	155,000	369,789	10,077	9,245	11,556	12,943	13,867	14,514	18,489	40,677	11,556

TORQUE GUIDE FOR **SOCKET HEAD CAP SCREWS (INCH)**

MATERI **ASTM A547** ALLOY STEEL

BOLT TENSION BASED ON **50** PERCENT YIELD

REQUIRED TORQUE (FtLbs)

BOLT SIZE	THREADS PER INCH	HEX A.F.	STRESS AREA $(in)^2$	MIN YIELD STRENGTH	BOLT TENSION	LoaDISC TS801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.20	DRY STEEL K=.440	CUSTOM INSERT 0.125
5/8	11	0.500	0.226	155,000	17,506	99	91	114	128	137	143	182	401	114
3/4	10	0.625	0.334	155,000	25,908	176	162	202	227	243	254	324	712	202
7/8	9	0.750	0.461	155,000	35,766	284	261	326	365	391	409	522	1,147	326
1	8	0.750	0.605	155,000	46,921	426	391	489	547	587	614	782	1,720	489
1 1/8	7	0.875	0.763	155,000	59,124	604	554	693	776	831	870	1,109	2,439	693
1 1/4	7	0.875	0.969	155,000	75,068	852	782	977	1,095	1,173	1,228	1,564	3,441	977
1 3/8	6	1.000	1.154	155,000	89,458	1,117	1,025	1,281	1,435	1,538	1,609	2,050	4,510	1,281
1 1/2	6	1.000	1.405	155,000	108,852	1,483	1,361	1,701	1,905	2,041	2,136	2,721	5,987	1,701
1 3/4	5	1.250	1.898	155,000	147,133	2,339	2,146	2,682	3,004	3,219	3,369	4,291	9,441	2,682
2	4.5	1.500	2.497	155,000	193,514	3,516	3,225	4,032	4,515	4,838	5,064	6,450	14,191	4,032
2 1/4	4.5	1.750	3.246	155,000	251,568	5,141	4,717	5,896	6,604	7,075	7,406	9,434	20,754	5,896
2 1/2	4	1.750	3.997	155,000	309,751	7,034	6,453	8,066	9,034	9,680	10,131	12,906	28,394	8,066
2 3/4	4	2.000	4.932	155,000	382,191	9,547	8,759	10,948	12,262	13,138	13,751	17,517	38,538	10,948
3	4	2.250	5.964	155,000	462,236	12,596	11,556	14,445	16,178	17,334	18,143	23,112	50,846	14,445

TORQUE GUIDE FOR **SOCKET HEAD CAP SCREWS (INCH)**

MATERI **ASTM A547** ALLOY STEEL

BOLT TENSION BASED ON **60** PERCENT YIELD

REQUIRED TORQUE (FtLbs)

BOLT SIZE	THREADS PER INCH	HEX A.F.	STRESS AREA $(in)^2$	MIN YIELD STRENGTH	BOLT TENSION	LoaDISC TS801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.20	DRY STEEL K=.440	CUSTOM INSERT 0.125
5/8	11	0.500	0.226	155,000	21,007	119	109	137	153	164	172	219	481	137
3/4	10	0.625	0.334	155,000	31,089	212	194	243	272	291	305	389	855	243
7/8	9	0.750	0.461	155,000	42,919	341	313	391	438	469	491	626	1,377	391
1	8	0.750	0.605	155,000	56,306	511	469	587	657	704	737	938	2,065	587
1 1/8	7	0.875	0.763	155,000	70,948	725	665	831	931	998	1,044	1,330	2,927	831
1 1/4	7	0.875	0.969	155,000	90,081	1,023	938	1,173	1,314	1,408	1,473	1,877	4,129	1,173
1 3/8	6	1.000	1.154	155,000	107,349	1,341	1,230	1,538	1,722	1,845	1,931	2,460	5,412	1,538
1 1/2	6	1.000	1.405	155,000	130,622	1,780	1,633	2,041	2,286	2,449	2,563	3,266	7,184	2,041
1 3/4	5	1.250	1.898	155,000	176,560	2,807	2,575	3,219	3,605	3,862	4,042	5,150	11,329	3,219
2	4.5	1.500	2.497	155,000	232,217	4,219	3,870	4,838	5,418	5,805	6,076	7,741	17,029	4,838
2 1/4	4.5	1.750	3.246	155,000	301,881	6,170	5,660	7,075	7,924	8,490	8,887	11,321	24,905	7,075
2 1/2	4	1.750	3.997	155,000	371,702	8,441	7,744	9,680	10,841	11,616	12,158	15,488	34,073	9,680
2 3/4	4	2.000	4.932	155,000	458,630	11,456	10,510	13,138	14,714	15,765	16,501	21,021	46,245	13,138
3	4	2.250	5.964	155,000	554,683	15,115	13,867	17,334	19,414	20,801	21,771	27,734	61,015	17,334

TORQUE GUIDE FOR **SOCKET HEAD CAP SCREWS (INCH)**

MATERI **ASTM A547** ALLOY STEEL

BOLT TENSION BASED ON **70** PERCENT YIELD

REQUIRED TORQUE (FtLbs)

BOLT SIZE	THREADS PER INCH	HEX A.F.	STRESS AREA $(in)^2$	MIN YIELD STRENGTH	BOLT TENSION	LoaDISC TS801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.20	DRY STEEL K=.440	CUSTOM INSERT 0.125
5/8	11	0.500	0.226	155,000	24,509	139	128	160	179	191	200	255	562	160
3/4	10	0.625	0.334	155,000	36,271	247	227	283	317	340	356	453	997	283
7/8	9	0.750	0.461	155,000	50,073	398	365	456	511	548	573	730	1,606	456
1	8	0.750	0.605	155,000	65,690	597	547	684	766	821	859	1,095	2,409	684
1 1/8	7	0.875	0.763	155,000	82,773	846	776	970	1,086	1,164	1,218	1,552	3,414	970
1 1/4	7	0.875	0.969	155,000	105,095	1,193	1,095	1,368	1,533	1,642	1,719	2,189	4,817	1,368
1 3/8	6	1.000	1.154	155,000	125,241	1,564	1,435	1,794	2,009	2,153	2,253	2,870	6,314	1,794
1 1/2	6	1.000	1.405	155,000	152,392	2,076	1,905	2,381	2,667	2,857	2,991	3,810	8,382	2,381
1 3/4	5	1.250	1.898	155,000	205,986	3,274	3,004	3,755	4,206	4,506	4,716	6,008	13,217	3,755
2	4.5	1.500	2.497	155,000	270,919	4,922	4,515	5,644	6,321	6,773	7,089	9,031	19,867	5,644
2 1/4	4.5	1.750	3.246	155,000	352,195	7,198	6,604	8,255	9,245	9,905	10,368	13,207	29,056	8,255
2 1/2	4	1.750	3.997	155,000	433,652	9,848	9,034	11,293	12,648	13,552	14,184	18,069	39,751	11,293
2 3/4	4	2.000	4.932	155,000	535,068	13,366	12,262	15,327	17,167	18,393	19,251	24,524	53,953	15,327
3	4	2.250	5.964	155,000	647,130	17,634	16,178	20,223	22,650	24,267	25,400	32,357	71,184	20,223

TORQUE GUIDE FOR **SOCKET HEAD CAP SCREWS (INCH)**

MATERI **ASTM A547** ALLOY STEEL

BOLT TENSION BASED ON **80** PERCENT YIELD

						REQUIRED TORQUE (FtLbs)								
BOLT SIZE	THREADS PER INCH	HEX A.F.	STRESS AREA $(in)^2$	MIN YIELD STRENGTH	BOLT TENSION	LoaDISC TS801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.20	DRY STEEL K=.440	CUSTOM INSERT 0.125
5/8	11	0.500	0.226	155,000	28,010	159	146	182	204	219	229	292	642	182
3/4	10	0.625	0.334	155,000	41,452	282	259	324	363	389	407	518	1,140	324
7/8	9	0.750	0.461	155,000	57,226	455	417	522	584	626	655	835	1,836	522
1	8	0.750	0.605	155,000	75,074	682	626	782	876	938	982	1,251	2,753	782
1 1/8	7	0.875	0.763	155,000	94,598	967	887	1,109	1,242	1,330	1,392	1,774	3,902	1,109
1 1/4	7	0.875	0.969	155,000	120,109	1,364	1,251	1,564	1,752	1,877	1,964	2,502	5,505	1,564
1 3/8	6	1.000	1.154	155,000	143,133	1,788	1,640	2,050	2,296	2,460	2,575	3,280	7,216	2,050
1 1/2	6	1.000	1.405	155,000	174,163	2,373	2,177	2,721	3,048	3,266	3,418	4,354	9,579	2,721
1 3/4	5	1.250	1.898	155,000	235,413	3,742	3,433	4,291	4,806	5,150	5,390	6,866	15,106	4,291
2	4.5	1.500	2.497	155,000	309,622	5,625	5,160	6,450	7,225	7,741	8,102	10,321	22,706	6,450
2 1/4	4.5	1.750	3.246	155,000	402,508	8,226	7,547	9,434	10,566	11,321	11,849	15,094	33,207	9,434
2 1/2	4	1.750	3.997	155,000	495,602	11,254	10,325	12,906	14,455	15,488	16,210	20,650	45,430	12,906
2 3/4	4	2.000	4.932	155,000	611,506	15,275	14,014	17,517	19,619	21,021	22,001	28,027	61,660	17,517
3	4	2.250	5.964	155,000	739,578	20,153	18,489	23,112	25,885	27,734	29,028	36,979	81,354	23,112

TORQUE GUIDE FOR **SOCKET HEAD CAP SCREWS (INCH)**

MATERI **ASTM A547** ALLOY STEEL

BOLT TENSION BASED ON **90** PERCENT YIELD

						REQUIRED TORQUE (FtLbs)								
BOLT SIZE	THREADS PER INCH	HEX A.F.	STRESS AREA $(in)^2$	MIN YIELD STRENGTH	BOLT TENSION	LoaDISC TS801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.20	DRY STEEL K=.440	CUSTOM INSERT 0.125
5/8	11	0.500	0.226	155,000	31,511	179	164	205	230	246	258	328	722	205
3/4	10	0.625	0.334	155,000	46,634	318	291	364	408	437	458	583	1,282	364
7/8	9	0.750	0.461	155,000	64,379	512	469	587	657	704	737	939	2,065	587
1	8	0.750	0.605	155,000	84,458	767	704	880	985	1,056	1,105	1,408	3,097	880
1 1/8	7	0.875	0.763	155,000	106,423	1,088	998	1,247	1,397	1,497	1,566	1,995	4,390	1,247
1 1/4	7	0.875	0.969	155,000	135,122	1,534	1,408	1,759	1,971	2,111	2,210	2,815	6,193	1,759
1 3/8	6	1.000	1.154	155,000	161,024	2,011	1,845	2,306	2,583	2,768	2,897	3,690	8,118	2,306
1 1/2	6	1.000	1.405	155,000	195,933	2,670	2,449	3,061	3,429	3,674	3,845	4,898	10,776	3,061
1 3/4	5	1.250	1.898	155,000	264,840	4,210	3,862	4,828	5,407	5,793	6,064	7,724	16,994	4,828
2	4.5	1.500	2.497	155,000	348,325	6,328	5,805	7,257	8,128	8,708	9,115	11,611	25,544	7,257
2 1/4	4.5	1.750	3.246	155,000	452,822	9,255	8,490	10,613	11,887	12,736	13,330	16,981	37,358	10,613
2 1/2	4	1.750	3.997	155,000	557,552	12,661	11,616	14,520	16,262	17,424	18,237	23,231	51,109	14,520
2 3/4	4	2.000	4.932	155,000	687,944	17,184	15,765	19,707	22,072	23,648	24,752	31,531	69,368	19,707
3	4	2.250	5.964	155,000	832,025	22,673	20,801	26,001	29,121	31,201	32,657	41,601	91,523	26,001

TORQUE GUIDE FOR **SOCKET HEAD CAP SCREWS (INCH)**

MATERI **ASTM A547** ALLOY STEEL

BOLT TENSION BASED ON **99** PERCENT YIELD

REQUIRED TORQUE (FtLbs)

BOLT SIZE	THREADS PER INCH	HEX A.F.	STRESS AREA $(in)^2$	MIN YIELD STRENGTH	BOLT TENSION	LoaDISC TS801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.20	DRY STEEL K=.440	CUSTOM INSERT 0.125
5/8	11	0.500	0.226	155,000	34,662	197	181	226	253	271	283	361	794	226
3/4	10	0.625	0.334	155,000	51,297	349	321	401	449	481	503	641	1,411	401
7/8	9	0.750	0.461	155,000	70,817	563	516	645	723	775	811	1,033	2,272	645
1	8	0.750	0.605	155,000	92,904	844	774	968	1,084	1,161	1,215	1,548	3,406	968
1 1/8	7	0.875	0.763	155,000	117,065	1,196	1,097	1,372	1,536	1,646	1,723	2,195	4,829	1,372
1 1/4	7	0.875	0.969	155,000	148,634	1,688	1,548	1,935	2,168	2,322	2,431	3,097	6,812	1,935
1 3/8	6	1.000	1.154	155,000	177,127	2,212	2,030	2,537	2,841	3,044	3,186	4,059	8,930	2,537
1 1/2	6	1.000	1.405	155,000	215,526	2,937	2,694	3,368	3,772	4,041	4,230	5,388	11,854	3,368
1 3/4	5	1.250	1.898	155,000	291,324	4,631	4,248	5,311	5,948	6,373	6,670	8,497	18,693	5,311
2	4.5	1.500	2.497	155,000	383,158	6,961	6,386	7,982	8,940	9,579	10,026	12,772	28,098	7,982
2 1/4	4.5	1.750	3.246	155,000	498,104	10,180	9,339	11,674	13,075	14,009	14,663	18,679	41,094	11,674
2 1/2	4	1.750	3.997	155,000	613,308	13,927	12,777	15,972	17,888	19,166	20,060	25,554	56,220	15,972
2 3/4	4	2.000	4.932	155,000	756,739	18,903	17,342	21,677	24,279	26,013	27,227	34,684	76,304	21,677
3	4	2.250	5.964	155,000	915,227	24,940	22,881	28,601	32,033	34,321	35,923	45,761	100,675	28,601

BOLT LOAD (METRIC) SOCKET HEAD CAP SCREWS B7

40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR ASTM **A193** GRADE **B7**

BOLT LOAD BASED ON 40 PERCENT YIELD

				REQUIRED TORQUE (N-m)								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	LoaDISC TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM 0.109
M20x2.5	30	245	70.90	155	142	177	199	213	223	284	624	155
M22x2.5	32	303	87.87	211	193	242	271	290	303	387	851	211
M24x3	36	353	102.09	267	245	306	343	368	385	490	1,078	267
M27x3	41	459	133.05	392	359	449	503	539	564	718	1,581	392
M30x3.5	46	561	162.35	531	487	609	682	731	765	974	2,143	531
M33x3.5	50	694	200.86	723	663	829	928	994	1,041	1,326	2,917	723
M36x4	55	817	236.53	928	852	1,064	1,192	1,277	1,337	1,703	3,747	928
M39x4	60	976	282.59	1,201	1,102	1,378	1,543	1,653	1,730	2,204	4,849	1,201
M42x4.5	65	1121	324.63	1,486	1,363	1,704	1,909	2,045	2,141	2,727	5,999	1,486
M45x4.5	70	1306	378.24	1,855	1,702	2,128	2,383	2,553	2,672	3,404	7,489	1,855
M48x5	75	1473	426.64	2,232	2,048	2,560	2,867	3,072	3,215	4,096	9,011	2,232
M52x5	80	1758	509.09	2,886	2,647	3,309	3,706	3,971	4,156	5,295	11,648	2,886
M56x5.5	85	2030	587.92	3,589	3,292	4,115	4,609	4,939	5,169	6,585	14,486	3,589
M60x5.5	90	2362	684.07	4,474	4,104	5,131	5,746	6,157	6,444	8,209	18,059	4,474
M64x6	95	2676	701.13	4,891	4,487	5,609	6,282	6,731	7,045	8,975	19,744	4,891
M68x6	100	3055	800.52	5,933	5,444	6,804	7,621	8,165	8,546	10,887	23,952	5,933
M72x6	105	3460	906.49	7,114	6,527	8,158	9,137	9,790	10,247	13,053	28,718	7,114
M76x6	110	3889	1,019.04	8,442	7,745	9,681	10,843	11,617	12,159	15,489	34,077	8,442
M80x6	115	4344	1,138.18	9,925	9,105	11,382	12,748	13,658	14,296	18,211	40,064	9,925
M90x6	130	5591	1,464.84	14,370	13,184	16,479	18,457	19,775	20,698	26,367	58,007	14,370
M100x6	145	6995	1,832.65	19,976	18,326	22,908	25,657	27,490	28,773	36,653	80,636	19,976
M110x6	155	8556	1,769.33	21,214	19,463	24,328	27,248	29,194	30,556	38,925	85,636	21,214
M125x6	180	11192	2,314.44	31,534	28,931	36,163	40,503	43,396	45,421	57,861	127,294	31,534

TORQUE GUIDE FOR ASTM **A193** GRADE **B7**

BOLT LOAD BASED ON 50 PERCENT YIELD

				REQUIRED TORQUE (N-m)								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	LoaDISC TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM 0.109
M20x2.5	30	245	88.62	193	177	222	248	266	278	354	780	193
M22x2.5	32	303	109.84	263	242	302	338	362	379	483	1,063	263
M24x3	36	353	127.61	334	306	383	429	459	481	613	1,348	334
M27x3	41	459	166.31	489	449	561	629	674	705	898	1,976	489
M30x3.5	46	561	202.94	664	609	761	852	913	956	1,218	2,679	664
M33x3.5	50	694	251.08	903	829	1,036	1,160	1,243	1,301	1,657	3,646	903
M36x4	55	817	295.67	1,160	1,064	1,331	1,490	1,597	1,671	2,129	4,683	1,160
M39x4	60	976	353.24	1,502	1,378	1,722	1,929	2,066	2,163	2,755	6,062	1,502
M42x4.5	65	1121	405.79	1,858	1,704	2,130	2,386	2,556	2,676	3,409	7,499	1,858
M45x4.5	70	1306	472.79	2,319	2,128	2,659	2,979	3,191	3,340	4,255	9,361	2,319
M48x5	75	1473	533.31	2,790	2,560	3,200	3,584	3,840	4,019	5,120	11,263	2,790
M52x5	80	1758	636.36	3,607	3,309	4,136	4,633	4,964	5,195	6,618	14,560	3,607
M56x5.5	85	2030	734.90	4,486	4,115	5,144	5,762	6,173	6,461	8,231	18,108	4,486
M60x5.5	90	2362	855.09	5,592	5,131	6,413	7,183	7,696	8,055	10,261	22,574	5,592
M64x6	95	2676	876.42	6,114	5,609	7,011	7,853	8,414	8,806	11,218	24,680	6,114
M68x6	100	3055	1,000.65	7,417	6,804	8,506	9,526	10,207	10,683	13,609	29,939	7,417
M72x6	105	3460	1,133.11	8,893	8,158	10,198	11,422	12,238	12,809	16,317	35,897	8,893
M76x6	110	3889	1,273.80	10,552	9,681	12,101	13,553	14,521	15,199	19,362	42,596	10,552
M80x6	115	4344	1,422.73	12,406	11,382	14,227	15,935	17,073	17,869	22,764	50,080	12,406
M90x6	130	5591	1,831.04	17,963	16,479	20,599	23,071	24,719	25,873	32,959	72,509	17,963
M100x6	145	6995	2,290.81	24,970	22,908	28,635	32,071	34,362	35,966	45,816	100,796	24,970
M110x6	155	8556	2,211.67	26,518	24,328	30,410	34,060	36,492	38,195	48,657	107,045	26,518
M125x6	180	11192	2,893.05	39,418	36,163	45,204	50,628	54,245	56,776	72,326	159,118	39,418

TORQUE GUIDE FOR ASTM **A193** GRADE **B7**

BOLT LOAD BASED ON 60 PERCENT YIELD

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM 0.109
M20x2.5	30	245	106.34	232	213	266	298	319	334	425	936	232
M22x2.5	32	303	131.80	316	290	362	406	435	455	580	1,276	316
M24x3	36	353	153.14	401	368	459	515	551	577	735	1,617	401
M27x3	41	459	199.58	587	539	674	754	808	846	1,078	2,371	587
M30x3.5	46	561	243.53	796	731	913	1,023	1,096	1,147	1,461	3,215	796
M33x3.5	50	694	301.29	1,084	994	1,243	1,392	1,491	1,561	1,989	4,375	1,084
M36x4	55	817	354.80	1,392	1,277	1,597	1,788	1,916	2,005	2,555	5,620	1,392
M39x4	60	976	423.89	1,802	1,653	2,066	2,314	2,480	2,595	3,306	7,274	1,802
M42x4.5	65	1121	486.95	2,229	2,045	2,556	2,863	3,068	3,211	4,090	8,999	2,229
M45x4.5	70	1306	567.35	2,783	2,553	3,191	3,574	3,830	4,008	5,106	11,234	2,783
M48x5	75	1473	639.97	3,348	3,072	3,840	4,301	4,608	4,823	6,144	13,516	3,348
M52x5	80	1758	763.64	4,328	3,971	4,964	5,559	5,956	6,234	7,942	17,472	4,328
M56x5.5	85	2030	881.88	5,383	4,939	6,173	6,914	7,408	7,753	9,877	21,729	5,383
M60x5.5	90	2362	1,026.10	6,711	6,157	7,696	8,619	9,235	9,666	12,313	27,089	6,711
M64x6	95	2676	1,051.70	7,337	6,731	8,414	9,423	10,096	10,567	13,462	29,616	7,337
M68x6	100	3055	1,200.78	8,900	8,165	10,207	11,431	12,248	12,820	16,331	35,927	8,900
M72x6	105	3460	1,359.73	10,671	9,790	12,238	13,706	14,685	15,370	19,580	43,076	10,671
M76x6	110	3889	1,528.56	12,663	11,617	14,521	16,264	17,426	18,239	23,234	51,115	12,663
M80x6	115	4344	1,707.27	14,887	13,658	17,073	19,121	20,487	21,443	27,316	60,096	14,887
M90x6	130	5591	2,197.25	21,555	19,775	24,719	27,685	29,663	31,047	39,551	87,011	21,555
M100x6	145	6995	2,748.97	29,964	27,490	34,362	38,486	41,235	43,159	54,979	120,955	29,964
M110x6	155	8556	2,654.00	31,821	29,194	36,492	40,872	43,791	45,835	58,388	128,454	31,821
M125x6	180	11192	3,471.66	47,301	43,396	54,245	60,754	65,094	68,131	86,792	190,941	47,301

TORQUE GUIDE FOR ASTM **A193** GRADE **B7**

BOLT LOAD BASED ON 70 PERCENT YIELD

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM 0.109
M20x2.5	30	245	124.07	270	248	310	347	372	390	496	1,092	270
M22x2.5	32	303	153.77	369	338	423	474	507	531	677	1,489	369
M24x3	36	353	178.66	467	429	536	600	643	673	858	1,887	467
M27x3	41	459	232.84	685	629	786	880	943	987	1,257	2,766	685
M30x3.5	46	561	284.12	929	852	1,065	1,193	1,279	1,338	1,705	3,750	929
M33x3.5	50	694	351.51	1,264	1,160	1,450	1,624	1,740	1,821	2,320	5,104	1,264
M36x4	55	817	413.94	1,624	1,490	1,863	2,086	2,235	2,340	2,980	6,557	1,624
M39x4	60	976	494.53	2,102	1,929	2,411	2,700	2,893	3,028	3,857	8,486	2,102
M42x4.5	65	1121	568.10	2,601	2,386	2,983	3,340	3,579	3,746	4,772	10,499	2,601
M45x4.5	70	1306	661.91	3,247	2,979	3,723	4,170	4,468	4,676	5,957	13,106	3,247
M48x5	75	1473	746.63	3,906	3,584	4,480	5,017	5,376	5,627	7,168	15,769	3,906
M52x5	80	1758	890.91	5,050	4,633	5,791	6,486	6,949	7,273	9,265	20,384	5,050
M56x5.5	85	2030	1,028.86	6,280	5,762	7,202	8,066	8,642	9,046	11,523	25,351	6,280
M60x5.5	90	2362	1,197.12	7,829	7,183	8,978	10,056	10,774	11,277	14,365	31,604	7,829
M64x6	95	2676	1,226.99	8,559	7,853	9,816	10,994	11,779	12,329	15,705	34,552	8,559
M68x6	100	3055	1,400.91	10,384	9,526	11,908	13,337	14,289	14,956	19,052	41,915	10,384
M72x6	105	3460	1,586.35	12,450	11,422	14,277	15,990	17,133	17,932	22,843	50,256	12,450
M76x6	110	3889	1,783.32	14,773	13,553	16,942	18,975	20,330	21,279	27,107	59,634	14,773
M80x6	115	4344	1,991.82	17,369	15,935	19,918	22,308	23,902	25,017	31,869	70,112	17,369
M90x6	130	5591	2,563.46	25,148	23,071	28,839	32,300	34,607	36,222	46,142	101,513	25,148
M100x6	145	6995	3,207.13	34,958	32,071	40,089	44,900	48,107	50,352	64,143	141,114	34,958
M110x6	155	8556	3,096.33	37,125	34,060	42,575	47,684	51,089	53,474	68,119	149,862	37,125
M125x6	180	11192	4,050.27	55,185	50,628	63,286	70,880	75,943	79,487	101,257	222,765	55,185

TORQUE GUIDE FOR ASTM **A193** GRADE **B7**

BOLT LOAD BASED ON 80 PERCENT YIELD

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM 0.109
M20x2.5	30	245	141.79	309	284	354	397	425	445	567	1,248	309
M22x2.5	32	303	175.74	421	387	483	541	580	607	773	1,701	421
M24x3	36	353	204.18	534	490	613	686	735	769	980	2,156	534
M27x3	41	459	266.10	783	718	898	1,006	1,078	1,128	1,437	3,161	783
M30x3.5	46	561	324.71	1,062	974	1,218	1,364	1,461	1,529	1,948	4,286	1,062
M33x3.5	50	694	401.73	1,445	1,326	1,657	1,856	1,989	2,081	2,651	5,833	1,445
M36x4	55	817	473.07	1,856	1,703	2,129	2,384	2,555	2,674	3,406	7,493	1,856
M39x4	60	976	565.18	2,403	2,204	2,755	3,086	3,306	3,461	4,408	9,699	2,403
M42x4.5	65	1121	649.26	2,972	2,727	3,409	3,818	4,090	4,281	5,454	11,998	2,972
M45x4.5	70	1306	756.47	3,710	3,404	4,255	4,766	5,106	5,344	6,808	14,978	3,710
M48x5	75	1473	853.29	4,464	4,096	5,120	5,734	6,144	6,430	8,192	18,021	4,464
M52x5	80	1758	1,018.18	5,771	5,295	6,618	7,412	7,942	8,312	10,589	23,296	5,771
M56x5.5	85	2030	1,175.84	7,177	6,585	8,231	9,219	9,877	10,338	13,169	28,973	7,177
M60x5.5	90	2362	1,368.14	8,948	8,209	10,261	11,492	12,313	12,888	16,418	36,119	8,948
M64x6	95	2676	1,402.27	9,782	8,975	11,218	12,564	13,462	14,090	17,949	39,488	9,782
M68x6	100	3055	1,601.04	11,867	10,887	13,609	15,242	16,331	17,093	21,774	47,903	11,867
M72x6	105	3460	1,812.98	14,228	13,053	16,317	18,275	19,580	20,494	26,107	57,435	14,228
M76x6	110	3889	2,038.08	16,883	15,489	19,362	21,685	23,234	24,318	30,979	68,154	16,883
M80x6	115	4344	2,276.36	19,850	18,211	22,764	25,495	27,316	28,591	36,422	80,128	19,850
M90x6	130	5591	2,929.67	28,740	26,367	32,959	36,914	39,551	41,396	52,734	116,015	28,740
M100x6	145	6995	3,665.29	39,952	36,653	45,816	51,314	54,979	57,545	73,306	161,273	39,952
M110x6	155	8556	3,538.66	42,429	38,925	48,657	54,495	58,388	61,113	77,851	171,271	42,429
M125x6	180	11192	4,628.88	63,069	57,861	72,326	81,005	86,792	90,842	115,722	254,589	63,069

TORQUE GUIDE FOR ASTM **A193** GRADE **B7**

BOLT LOAD BASED ON 90 PERCENT YIELD

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM 0.109
M20x2.5	30	245	159.52	348	319	399	447	479	501	638	1,404	348
M22x2.5	32	303	197.71	474	435	544	609	652	683	870	1,914	474
M24x3	36	353	229.70	601	551	689	772	827	866	1,103	2,426	601
M27x3	41	459	299.36	881	808	1,010	1,132	1,212	1,269	1,617	3,556	881
M30x3.5	46	561	365.30	1,195	1,096	1,370	1,534	1,644	1,721	2,192	4,822	1,195
M33x3.5	50	694	451.94	1,626	1,491	1,864	2,088	2,237	2,342	2,983	6,562	1,626
M36x4	55	817	532.20	2,088	1,916	2,395	2,682	2,874	3,008	3,832	8,430	2,088
M39x4	60	976	635.83	2,703	2,480	3,100	3,472	3,720	3,893	4,959	10,911	2,703
M42x4.5	65	1121	730.42	3,344	3,068	3,835	4,295	4,602	4,816	6,136	13,498	3,344
M45x4.5	70	1306	851.03	4,174	3,830	4,787	5,361	5,744	6,013	7,659	16,850	4,174
M48x5	75	1473	959.95	5,022	4,608	5,760	6,451	6,912	7,234	9,216	20,274	5,022
M52x5	80	1758	1,145.45	6,492	5,956	7,445	8,339	8,935	9,351	11,913	26,208	6,492
M56x5.5	85	2030	1,322.82	8,074	7,408	9,260	10,371	11,112	11,630	14,816	32,594	8,074
M60x5.5	90	2362	1,539.16	10,066	9,235	11,544	12,929	13,852	14,499	18,470	40,634	10,066
M64x6	95	2676	1,577.55	11,005	10,096	12,620	14,135	15,145	15,851	20,193	44,424	11,005
M68x6	100	3055	1,801.17	13,350	12,248	15,310	17,147	18,372	19,229	24,496	53,891	13,350
M72x6	105	3460	2,039.60	16,007	14,685	18,356	20,559	22,028	23,056	29,370	64,614	16,007
M76x6	110	3889	2,292.84	18,994	17,426	21,782	24,396	26,138	27,358	34,851	76,673	18,994
M80x6	115	4344	2,560.91	22,331	20,487	25,609	28,682	30,731	32,165	40,974	90,144	22,331
M90x6	130	5591	3,295.88	32,333	29,663	37,079	41,528	44,494	46,571	59,326	130,517	32,333
M100x6	145	6995	4,123.45	44,946	41,235	51,543	57,728	61,852	64,738	82,469	181,432	44,946
M110x6	155	8556	3,981.00	47,732	43,791	54,739	61,307	65,686	68,752	87,582	192,680	47,732
M125x6	180	11192	5,207.50	70,952	65,094	81,367	91,131	97,641	102,197	130,187	286,412	70,952

TORQUE GUIDE FOR ASTM **A193** GRADE **B7**												
BOLT LOAD BASED ON			99	PERCENT YIELD								
				REQUIRED TORQUE (N-m)								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM 0.109
M20x2.5	30	245	175.47	383	351	439	491	526	551	702	1,544	383
M22x2.5	32	303	217.48	522	478	598	670	718	751	957	2,105	522
M24x3	36	353	252.68	661	606	758	849	910	952	1,213	2,668	661
M27x3	41	459	329.30	969	889	1,111	1,245	1,334	1,396	1,778	3,912	969
M30x3.5	46	561	401.83	1,314	1,205	1,507	1,688	1,808	1,893	2,411	5,304	1,314
M33x3.5	50	694	497.14	1,788	1,641	2,051	2,297	2,461	2,576	3,281	7,218	1,788
M36x4	55	817	585.42	2,297	2,108	2,634	2,951	3,161	3,309	4,215	9,273	2,297
M39x4	60	976	699.41	2,973	2,728	3,410	3,819	4,092	4,283	5,455	12,002	2,973
M42x4.5	65	1121	803.46	3,678	3,375	4,218	4,724	5,062	5,298	6,749	14,848	3,678
M45x4.5	70	1306	936.13	4,592	4,213	5,266	5,898	6,319	6,614	8,425	18,535	4,592
M48x5	75	1473	1,055.94	5,525	5,069	6,336	7,096	7,603	7,958	10,137	22,302	5,525
M52x5	80	1758	1,260.00	7,142	6,552	8,190	9,173	9,828	10,287	13,104	28,829	7,142
M56x5.5	85	2030	1,455.10	8,882	8,149	10,186	11,408	12,223	12,793	16,297	35,854	8,882
M60x5.5	90	2362	1,693.07	11,073	10,158	12,698	14,222	15,238	15,949	20,317	44,697	11,073
M64x6	95	2676	1,735.31	12,106	11,106	13,882	15,548	16,659	17,436	22,212	48,866	12,106
M68x6	100	3055	1,981.28	14,685	13,473	16,841	18,862	20,209	21,152	26,945	59,280	14,685
M72x6	105	3460	2,243.56	17,607	16,154	20,192	22,615	24,230	25,361	32,307	71,076	17,607
M76x6	110	3889	2,522.13	20,893	19,168	23,960	26,835	28,752	30,094	38,336	84,340	20,893
M80x6	115	4344	2,817.00	24,564	22,536	28,170	31,550	33,804	35,381	45,072	99,158	24,564
M90x6	130	5591	3,625.47	35,566	32,629	40,787	45,681	48,944	51,228	65,258	143,569	35,566
M100x6	145	6995	4,535.80	49,440	45,358	56,697	63,501	68,037	71,212	90,716	199,575	49,440
M110x6	155	8556	4,379.10	52,505	48,170	60,213	67,438	72,255	75,627	96,340	211,948	52,505
M125x6	180	11192	5,728.24	78,047	71,603	89,504	100,244	107,405	112,417	143,206	315,053	78,047

TORQUE GUIDE FOR **SOCKET HEAD CAP SCREWS (INCH)**

MATERI **ASTM A547** ALLOY STEEL

BOLT TENSION BASED ON **99** PERCENT YIELD

REQUIRED TORQUE (FtLbs)

BOLT SIZE	THREADS PER INCH	HEX A.F.	STRESS AREA $(in)^2$	MIN YIELD STRENGTH	BOLT TENSION	LoaDISC TS801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.20	DRY STEEL K=.440	CUSTOM INSERT 0.125
5/8	11	0.500	0.226	155,000	34,662	197	181	226	253	271	283	361	794	226
3/4	10	0.625	0.334	155,000	51,297	349	321	401	449	481	503	641	1,411	401
7/8	9	0.750	0.461	155,000	70,817	563	516	645	723	775	811	1,033	2,272	645
1	8	0.750	0.605	155,000	92,904	844	774	968	1,084	1,161	1,215	1,548	3,406	968
1 1/8	7	0.875	0.763	155,000	117,065	1,196	1,097	1,372	1,536	1,646	1,723	2,195	4,829	1,372
1 1/4	7	0.875	0.969	155,000	148,634	1,688	1,548	1,935	2,168	2,322	2,431	3,097	6,812	1,935
1 3/8	6	1.000	1.154	155,000	177,127	2,212	2,030	2,537	2,841	3,044	3,186	4,059	8,930	2,537
1 1/2	6	1.000	1.405	155,000	215,526	2,937	2,694	3,368	3,772	4,041	4,230	5,388	11,854	3,368
1 3/4	5	1.250	1.898	155,000	291,324	4,631	4,248	5,311	5,948	6,373	6,670	8,497	18,693	5,311
2	4.5	1.500	2.497	155,000	383,158	6,961	6,386	7,982	8,940	9,579	10,026	12,772	28,098	7,982
2 1/4	4.5	1.750	3.246	155,000	498,104	10,180	9,339	11,674	13,075	14,009	14,663	18,679	41,094	11,674
2 1/2	4	1.750	3.997	155,000	613,308	13,927	12,777	15,972	17,888	19,166	20,060	25,554	56,220	15,972
2 3/4	4	2.000	4.932	155,000	756,739	18,903	17,342	21,677	24,279	26,013	27,227	34,684	76,304	21,677
3	4	2.250	5.964	155,000	915,227	24,940	22,881	28,601	32,033	34,321	35,923	45,761	100,675	28,601

BOLT LOAD METRIC (GRADE 8.8)
40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR ISO R898 **CLASS 8.8**
MINIMUM YIELD **660 MPa** ***95726 p.s.i.***
BOLT LOAD BASED ON **40** PERCENT YIELD

REQUIRED TORQUE (N-m)
(To convert to ft/lbs multiply these torque values x .7376)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	BOLT LOAD (LBS)	LoaDISC TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPH. K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPH. K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300 K=.300	PLUG IN (K) 0.15
M20x2.5	30	245	65	14,529	141	129	162	181	194	203	259	388	194
M22x2.5	32	303	80	18,007	192	176	220	247	264	277	352	529	264
M24x3	36	353	93	20,921	243	223	279	313	335	351	447	670	335
M27x3	41	459	121	27,266	357	327	409	458	491	514	655	982	491
M30x3.5	46	561	148	33,271	484	444	555	622	666	697	888	1,332	666
M33x3.5	50	694	183	41,162	659	604	755	846	906	949	1,209	1,813	906
M36x4	55	817	216	48,473	846	776	970	1,087	1,164	1,219	1,553	2,329	1,164
M39x4	60	976	258	57,911	1,095	1,005	1,256	1,407	1,507	1,577	2,009	3,014	1,507
M42x4.5	65	1121	296	66,526	1,355	1,243	1,554	1,740	1,864	1,951	2,486	3,729	1,864
M45x4.5	70	1306	345	77,511	1,691	1,552	1,940	2,172	2,327	2,436	3,103	4,655	2,327
M48x5	75	1473	389	87,431	2,035	1,867	2,334	2,614	2,800	2,931	3,734	5,601	2,800
M52x5	80	1758	464	104,327	2,630	2,413	3,017	3,379	3,620	3,789	4,827	7,240	3,620
M56x5.5	85	2030	536	120,481	3,271	3,001	3,752	4,202	4,502	4,712	6,003	9,004	4,502
M60x5.5	90	2362	624	140,185	4,078	3,742	4,677	5,238	5,612	5,874	7,483	11,225	5,612
M64x6	95	2676	706	158,818	4,928	4,522	5,652	6,330	6,782	7,099	9,043	13,565	6,782
M68x6	100	3055	807	181,330	5,979	5,485	6,856	7,679	8,228	8,612	10,970	16,455	8,228
M72x6	105	3460	913	205,334	7,168	6,577	8,221	9,207	9,865	10,325	13,153	19,730	9,865
M76x6	110	3889	1,027	230,829	8,506	7,804	9,755	10,925	11,706	12,252	15,608	23,412	11,706
M80x6	115	4344	1,147	257,816	10,001	9,175	11,469	12,845	13,762	14,405	18,350	27,525	13,762
M90x6	130	5591	1,476	331,809	14,480	13,284	16,605	18,598	19,926	20,856	26,568	39,852	19,926
M100x6	145	6995	1,847	415,124	20,128	18,466	23,083	25,853	27,700	28,992	36,933	55,399	27,700
M110x6	155	8556	2,259	507,761	27,082	24,846	31,057	34,784	37,269	39,008	49,692	74,538	37,269
M125x6	180	11192	2,955	664,196	40,257	36,933	46,166	51,706	55,399	57,984	73,865	110,798	55,399

TORQUE GUIDE FOR ISO R898 **CLASS 8.8**

MINIMUM YIELD **660 MPa** *95726 p.s.i.*

BOLT LOAD BASED ON **50** PERCENT YIELD

REQUIRED TORQUE (N-m)

(To convert to ft/lbs multiply these torque values x .7376)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	BOLT LOAD (LBS)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPH. K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPH. K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300 K=.300	PLUG IN (K) 0.15
M20x2.5	30	245	81	18,161	176	162	202	226	242	254	323	485	242
M22x2.5	32	303	100	22,509	240	220	275	308	330	346	441	661	330
M24x3	36	353	116	26,152	304	279	349	391	419	438	558	838	419
M27x3	41	459	152	34,082	446	409	512	573	614	643	819	1,228	614
M30x3.5	46	561	185	41,589	605	555	694	777	833	871	1,110	1,665	833
M33x3.5	50	694	229	51,453	823	755	944	1,057	1,133	1,186	1,511	2,266	1,133
M36x4	55	817	270	60,591	1,058	970	1,213	1,358	1,455	1,523	1,941	2,911	1,455
M39x4	60	976	322	72,389	1,369	1,256	1,570	1,758	1,884	1,972	2,512	3,768	1,884
M42x4.5	65	1121	370	83,158	1,693	1,554	1,942	2,175	2,330	2,439	3,107	4,661	2,330
M45x4.5	70	1306	431	96,889	2,114	1,940	2,424	2,715	2,909	3,045	3,879	5,819	2,909
M48x5	75	1473	486	109,289	2,544	2,334	2,917	3,267	3,500	3,664	4,667	7,001	3,500
M52x5	80	1758	580	130,409	3,288	3,017	3,771	4,223	4,525	4,736	6,033	9,050	4,525
M56x5.5	85	2030	670	150,602	4,089	3,752	4,690	5,252	5,627	5,890	7,503	11,255	5,627
M60x5.5	90	2362	779	175,231	5,098	4,677	5,846	6,548	7,015	7,343	9,354	14,031	7,015
M64x6	95	2676	883	198,523	6,161	5,652	7,065	7,913	8,478	8,873	11,304	16,956	8,478
M68x6	100	3055	1,008	226,663	7,473	6,856	8,570	9,599	10,285	10,764	13,713	20,569	10,285
M72x6	105	3460	1,142	256,668	8,961	8,221	10,276	11,509	12,331	12,906	16,441	24,662	12,331
M76x6	110	3889	1,284	288,537	10,633	9,755	12,193	13,657	14,632	15,315	19,510	29,264	14,632
M80x6	115	4344	1,434	322,270	12,501	11,469	14,336	16,056	17,203	18,006	22,937	34,406	17,203
M90x6	130	5591	1,845	414,761	18,100	16,605	20,756	23,247	24,908	26,070	33,210	49,816	24,908
M100x6	145	6995	2,308	518,905	25,160	23,083	28,854	32,316	34,624	36,240	46,166	69,249	34,624
M110x6	155	8556	2,823	634,701	33,853	31,057	38,822	43,480	46,586	48,760	62,115	93,172	46,586
M125x6	180	11192	3,693	830,245	50,321	46,166	57,707	64,632	69,249	72,480	92,331	138,497	69,249

TORQUE GUIDE FOR ISO R898 **CLASS 8.8**

MINIMUM YIELD **660 MPa** *95726 p.s.i.*

BOLT LOAD BASED ON **60** PERCENT YIELD

REQUIRED TORQUE (N-m)

(To convert to ft/lbs multiply these torque values x .7376)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	BOLT LOAD (LBS)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPH. K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPH. K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300 K=.300	PLUG IN (K) 0.15
M20x2.5	30	245	97	21,793	211	194	242	271	291	304	388	582	291
M22x2.5	32	303	120	27,010	288	264	330	370	397	415	529	793	397
M24x3	36	353	140	31,382	365	335	419	469	503	526	670	1,005	503
M27x3	41	459	182	40,899	535	491	614	688	737	771	982	1,474	737
M30x3.5	46	561	222	49,907	726	666	833	932	999	1,046	1,332	1,998	999
M33x3.5	50	694	275	61,744	988	906	1,133	1,269	1,360	1,423	1,813	2,719	1,360
M36x4	55	817	323	72,709	1,269	1,164	1,455	1,630	1,747	1,828	2,329	3,493	1,747
M39x4	60	976	386	86,866	1,643	1,507	1,884	2,110	2,261	2,366	3,014	4,521	2,261
M42x4.5	65	1121	444	99,789	2,032	1,864	2,330	2,610	2,797	2,927	3,729	5,593	2,797
M45x4.5	70	1306	517	116,267	2,537	2,327	2,909	3,258	3,491	3,654	4,655	6,982	3,491
M48x5	75	1473	583	131,147	3,052	2,800	3,500	3,920	4,200	4,396	5,601	8,401	4,200
M52x5	80	1758	696	156,491	3,946	3,620	4,525	5,068	5,430	5,683	7,240	10,860	5,430
M56x5.5	85	2030	804	180,722	4,907	4,502	5,627	6,303	6,753	7,068	9,004	13,506	6,753
M60x5.5	90	2362	935	210,278	6,118	5,612	7,015	7,857	8,419	8,811	11,225	16,837	8,419
M64x6	95	2676	1,060	238,227	7,393	6,782	8,478	9,495	10,173	10,648	13,565	20,347	10,173
M68x6	100	3055	1,210	271,996	8,968	8,228	10,285	11,519	12,341	12,917	16,455	24,683	12,341
M72x6	105	3460	1,370	308,001	10,753	9,865	12,331	13,811	14,797	15,488	19,730	29,594	14,797
M76x6	110	3889	1,540	346,244	12,759	11,706	14,632	16,388	17,559	18,378	23,412	35,117	17,559
M80x6	115	4344	1,720	386,724	15,001	13,762	17,203	19,267	20,644	21,607	27,525	41,287	20,644
M90x6	130	5591	2,214	497,713	21,720	19,926	24,908	27,897	29,889	31,284	39,852	59,779	29,889
M100x6	145	6995	2,770	622,685	30,192	27,700	34,624	38,779	41,549	43,488	55,399	83,099	41,549
M110x6	155	8556	3,388	761,641	40,623	37,269	46,586	52,176	55,903	58,512	74,538	111,807	55,903
M125x6	180	11192	4,432	996,294	60,385	55,399	69,249	77,558	83,098	86,976	110,798	166,197	83,098

TORQUE GUIDE FOR ISO R898 **CLASS 8.8**

MINIMUM YIELD **660 MPa** ***95726 p.s.i.***

BOLT LOAD BASED ON **70** PERCENT YIELD

REQUIRED TORQUE (N-m)

(To convert to ft/lbs multiply these torque values x .7376)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	BOLT LOAD (LBS)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPH. K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPH. K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300 K=.300	PLUG IN (K) 0.15
M20x2.5	30	245	113	25,425	247	226	283	317	339	355	452	679	339
M22x2.5	32	303	140	31,512	336	308	385	432	463	484	617	925	463
M24x3	36	353	163	36,612	426	391	489	547	586	614	782	1,173	586
M27x3	41	459	212	47,715	625	573	716	802	860	900	1,146	1,719	860
M30x3.5	46	561	259	58,224	847	777	971	1,088	1,166	1,220	1,554	2,331	1,166
M33x3.5	50	694	320	72,034	1,153	1,057	1,322	1,480	1,586	1,660	2,115	3,172	1,586
M36x4	55	817	377	84,827	1,481	1,358	1,698	1,902	2,038	2,133	2,717	4,075	2,038
M39x4	60	976	451	101,344	1,916	1,758	2,198	2,461	2,637	2,760	3,516	5,275	2,637
M42x4.5	65	1121	518	116,421	2,371	2,175	2,719	3,045	3,263	3,415	4,350	6,525	3,263
M45x4.5	70	1306	603	135,645	2,960	2,715	3,394	3,801	4,073	4,263	5,431	8,146	4,073
M48x5	75	1473	681	153,005	3,561	3,267	4,084	4,574	4,901	5,129	6,534	9,801	4,901
M52x5	80	1758	812	182,572	4,603	4,223	5,279	5,912	6,335	6,630	8,446	12,670	6,335
M56x5.5	85	2030	938	210,842	5,725	5,252	6,565	7,353	7,878	8,246	10,505	15,757	7,878
M60x5.5	90	2362	1,091	245,324	7,137	6,548	8,185	9,167	9,822	10,280	13,096	19,643	9,822
M64x6	95	2676	1,236	277,932	8,625	7,913	9,891	11,078	11,869	12,423	15,825	23,738	11,869
M68x6	100	3055	1,412	317,328	10,463	9,599	11,999	13,438	14,398	15,070	19,198	28,797	14,398
M72x6	105	3460	1,598	359,335	12,545	11,509	14,386	16,113	17,263	18,069	23,018	34,527	17,263
M76x6	110	3889	1,797	403,951	14,886	13,657	17,071	19,119	20,485	21,441	27,313	40,970	20,485
M80x6	115	4344	2,007	451,178	17,501	16,056	20,070	22,479	24,084	25,208	32,112	48,168	24,084
M90x6	130	5591	2,583	580,665	25,340	23,247	29,059	32,546	34,871	36,498	46,495	69,742	34,871
M100x6	145	6995	3,232	726,466	35,225	32,316	40,395	45,243	48,474	50,736	64,632	96,948	48,474
M110x6	155	8556	3,953	888,581	47,394	43,480	54,351	60,873	65,221	68,264	86,961	130,441	65,221
M125x6	180	11192	5,171	1,162,343	70,449	64,632	80,790	90,485	96,948	101,472	129,264	193,896	96,948

TORQUE GUIDE FOR ISO R898 **CLASS 8.8**

MINIMUM YIELD **660 MPa** ***95726 p.s.i.***

BOLT LOAD BASED ON **80** PERCENT YIELD

REQUIRED TORQUE (N-m)

(To convert to ft/lbs multiply these torque values x .7376)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	BOLT LOAD (LBS)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPH. K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPH. K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300 K=.300	PLUG IN (K) 0.15
M20x2.5	30	245	129	29,057	282	259	323	362	388	406	517	776	388
M22x2.5	32	303	160	36,014	384	352	441	493	529	553	705	1,057	529
M24x3	36	353	186	41,843	487	447	558	625	670	701	893	1,340	670
M27x3	41	459	243	54,532	714	655	819	917	982	1,028	1,310	1,965	982
M30x3.5	46	561	296	66,542	968	888	1,110	1,243	1,332	1,394	1,776	2,664	1,332
M33x3.5	50	694	366	82,325	1,317	1,209	1,511	1,692	1,813	1,897	2,417	3,626	1,813
M36x4	55	817	431	96,945	1,692	1,553	1,941	2,174	2,329	2,437	3,105	4,658	2,329
M39x4	60	976	515	115,822	2,190	2,009	2,512	2,813	3,014	3,155	4,019	6,028	3,014
M42x4.5	65	1121	592	133,052	2,710	2,486	3,107	3,480	3,729	3,903	4,972	7,458	3,729
M45x4.5	70	1306	690	155,022	3,382	3,103	3,879	4,344	4,655	4,872	6,206	9,310	4,655
M48x5	75	1473	778	174,863	4,070	3,734	4,667	5,227	5,601	5,862	7,467	11,201	5,601
M52x5	80	1758	928	208,654	5,261	4,827	6,033	6,757	7,240	7,578	9,653	14,480	7,240
M56x5.5	85	2030	1,072	240,962	6,543	6,003	7,503	8,404	9,004	9,424	12,005	18,008	9,004
M60x5.5	90	2362	1,247	280,370	8,157	7,483	9,354	10,476	11,225	11,749	14,966	22,450	11,225
M64x6	95	2676	1,413	317,636	9,857	9,043	11,304	12,660	13,565	14,198	18,086	27,129	13,565
M68x6	100	3055	1,613	362,661	11,957	10,970	13,713	15,358	16,455	17,223	21,940	32,910	16,455
M72x6	105	3460	1,827	410,668	14,337	13,153	16,441	18,414	19,730	20,650	26,306	39,459	19,730
M76x6	110	3889	2,054	461,659	17,012	15,608	19,510	21,851	23,412	24,504	31,215	46,823	23,412
M80x6	115	4344	2,294	515,632	20,001	18,350	22,937	25,690	27,525	28,809	36,700	55,050	27,525
M90x6	130	5591	2,952	663,617	28,959	26,568	33,210	37,196	39,852	41,712	53,137	79,705	39,852
M100x6	145	6995	3,693	830,247	40,257	36,933	46,166	51,706	55,399	57,984	73,865	110,798	55,399
M110x6	155	8556	4,517	1,015,522	54,164	49,692	62,115	69,569	74,538	78,016	99,384	149,076	74,538
M125x6	180	11192	5,909	1,328,391	80,513	73,865	92,331	103,411	110,798	115,968	147,730	221,596	110,798

TORQUE GUIDE FOR ISO R898 **CLASS 8.8**

MINIMUM YIELD 660 MPa *95726 p.s.i.*

BOLT LOAD BASED ON **90** PERCENT YIELD

REQUIRED TORQUE (N-m)

(To convert to ft/lbs multiply these torque values x .7376)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	BOLT LOAD (LBS)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPH. K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPH. K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300 K=.300	PLUG IN (K) 0.15
M20x2.5	30	245	145	32,690	317	291	364	407	436	457	582	872	436
M22x2.5	32	303	180	40,515	432	397	496	555	595	623	793	1,190	595
M24x3	36	353	209	47,073	548	503	628	704	754	789	1,005	1,508	754
M27x3	41	459	273	61,348	803	737	921	1,032	1,105	1,157	1,474	2,210	1,105
M30x3.5	46	561	333	74,860	1,089	999	1,249	1,399	1,499	1,568	1,998	2,997	1,499
M33x3.5	50	694	412	92,615	1,482	1,360	1,699	1,903	2,039	2,135	2,719	4,079	2,039
M36x4	55	817	485	109,063	1,904	1,747	2,183	2,445	2,620	2,742	3,493	5,240	2,620
M39x4	60	976	580	130,299	2,464	2,261	2,826	3,165	3,391	3,549	4,521	6,782	3,391
M42x4.5	65	1121	666	149,684	3,048	2,797	3,496	3,915	4,195	4,391	5,593	8,390	4,195
M45x4.5	70	1306	776	174,400	3,805	3,491	4,364	4,888	5,237	5,481	6,982	10,473	5,237
M48x5	75	1473	875	196,721	4,578	4,200	5,251	5,881	6,301	6,595	8,401	12,601	6,301
M52x5	80	1758	1,044	234,736	5,919	5,430	6,787	7,602	8,145	8,525	10,860	16,290	8,145
M56x5.5	85	2030	1,206	271,083	7,361	6,753	8,441	9,454	10,129	10,602	13,506	20,259	10,129
M60x5.5	90	2362	1,403	315,416	9,176	8,419	10,523	11,786	12,628	13,217	16,837	25,256	12,628
M64x6	95	2676	1,590	357,341	11,089	10,173	12,717	14,243	15,260	15,972	20,347	30,520	15,260
M68x6	100	3055	1,815	407,993	13,452	12,341	15,427	17,278	18,512	19,376	24,683	37,024	18,512
M72x6	105	3460	2,055	462,002	16,129	14,797	18,497	20,716	22,196	23,232	29,594	44,392	22,196
M76x6	110	3889	2,310	519,366	19,139	17,559	21,948	24,582	26,338	27,567	35,117	52,676	26,338
M80x6	115	4344	2,580	580,086	22,502	20,644	25,805	28,901	30,965	32,411	41,287	61,931	30,965
M90x6	130	5591	3,321	746,570	32,579	29,889	37,362	41,845	44,834	46,926	59,779	89,668	44,834
M100x6	145	6995	4,155	934,028	45,289	41,549	51,937	58,169	62,324	65,232	83,099	124,648	62,324
M110x6	155	8556	5,082	1,142,462	60,935	55,903	69,879	78,265	83,855	87,768	111,807	167,710	83,855
M125x6	180	11192	6,648	1,494,440	90,577	83,098	103,873	116,338	124,647	130,464	166,197	249,295	124,647

TORQUE GUIDE FOR ISO R898 **CLASS 8.8**

MINIMUM YIELD 660 MPa *95726 p.s.i.*

BOLT LOAD BASED ON **99** PERCENT YIELD

REQUIRED TORQUE (N-m)

(To convert to ft/lbs multiply these torque values x .7376)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	BOLT LOAD (LBS)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPH. K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPH. K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300 K=.300	PLUG IN (K) 0.15
M20x2.5	30	245	160	35,959	349	320	400	448	480	502	640	960	480
M22x2.5	32	303	198	44,567	475	436	545	611	654	685	872	1,308	654
M24x3	36	353	230	51,780	603	553	691	774	829	868	1,106	1,658	829
M27x3	41	459	300	67,483	883	811	1,013	1,135	1,216	1,273	1,621	2,432	1,216
M30x3.5	46	561	366	82,346	1,198	1,099	1,374	1,538	1,648	1,725	2,198	3,297	1,648
M33x3.5	50	694	453	101,877	1,630	1,496	1,869	2,094	2,243	2,348	2,991	4,487	2,243
M36x4	55	817	534	119,970	2,094	1,921	2,402	2,690	2,882	3,016	3,842	5,764	2,882
M39x4	60	976	638	143,329	2,710	2,487	3,108	3,481	3,730	3,904	4,973	7,460	3,730
M42x4.5	65	1121	732	164,652	3,353	3,076	3,845	4,307	4,614	4,830	6,152	9,229	4,614
M45x4.5	70	1306	853	191,840	4,186	3,840	4,800	5,376	5,760	6,029	7,680	11,521	5,760
M48x5	75	1473	963	216,393	5,036	4,620	5,776	6,469	6,931	7,254	9,241	13,861	6,931
M52x5	80	1758	1,149	258,210	6,510	5,973	7,466	8,362	8,959	9,377	11,946	17,918	8,959
M56x5.5	85	2030	1,326	298,191	8,097	7,428	9,285	10,400	11,142	11,662	14,856	22,285	11,142
M60x5.5	90	2362	1,543	346,958	10,094	9,260	11,576	12,965	13,891	14,539	18,521	27,781	13,891
M64x6	95	2676	1,749	393,075	12,198	11,191	13,988	15,667	16,786	17,569	22,381	33,572	16,786
M68x6	100	3055	1,996	448,793	14,797	13,576	16,969	19,006	20,363	21,314	27,151	40,727	20,363
M72x6	105	3460	2,261	508,202	17,742	16,277	20,346	22,788	24,415	25,555	32,554	48,831	24,415
M76x6	110	3889	2,541	571,302	21,053	19,314	24,143	27,040	28,972	30,324	38,629	57,943	28,972
M80x6	115	4344	2,839	638,095	24,752	22,708	28,385	31,791	34,062	35,652	45,416	68,124	34,062
M90x6	130	5591	3,653	821,227	35,837	32,878	41,098	46,030	49,317	51,619	65,757	98,635	49,317
M100x6	145	6995	4,570	1,027,431	49,818	45,704	57,130	63,986	68,556	71,756	91,408	137,113	68,556
M110x6	155	8556	5,590	1,256,708	67,028	61,494	76,867	86,091	92,241	96,545	122,987	184,481	92,241
M125x6	180	11192	7,313	1,643,884	99,635	91,408	114,260	127,971	137,112	143,511	182,816	274,224	137,112

BOLT LOAD METRIC (GRADE 10.9)
40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR ISO R898 **CLASS 10.9**
MINIMUM YIELD **940** ***136338 p.s.i.***
BOLT LOAD BASED ON **40** PERCENT YIELD

REQUIRED TORQUE (N-m)
(To convert to ft/lbs multiply these torque values x .7376)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	BOLT LOAD (LBS)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPH. K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPH. K=.150	API SA2 K=.157	MACH'NE OIL K=.200	DRY STEEL K=.300 K=.300	PLUG IN (K) K=.300 0.1
M20x2.5	30	245	92	20,692	201	184	230	258	276	289	368	552	184
M22x2.5	32	303	114	25,646	274	251	314	351	376	394	502	753	251
M24x3	36	353	133	29,797	347	318	398	445	477	499	636	954	318
M27x3	41	459	173	38,833	508	466	583	653	700	732	933	1,399	466
M30x3.5	46	561	211	47,386	689	632	790	885	949	993	1,265	1,897	632
M33x3.5	50	694	261	58,625	938	861	1,076	1,205	1,291	1,351	1,721	2,582	861
M36x4	55	817	307	69,037	1,205	1,106	1,382	1,548	1,658	1,736	2,211	3,317	1,106
M39x4	60	976	367	82,479	1,560	1,431	1,789	2,003	2,146	2,247	2,862	4,293	1,431
M42x4.5	65	1121	421	94,749	1,930	1,770	2,213	2,478	2,655	2,779	3,540	5,311	1,770
M45x4.5	70	1306	491	110,395	2,409	2,210	2,762	3,094	3,315	3,469	4,420	6,630	2,210
M48x5	75	1473	554	124,524	2,898	2,659	3,324	3,722	3,988	4,174	5,318	7,977	2,659
M52x5	80	1758	661	148,587	3,746	3,437	4,296	4,812	5,156	5,396	6,874	10,311	3,437
M56x5.5	85	2030	763	171,594	4,659	4,275	5,343	5,984	6,412	6,711	8,549	12,824	4,275
M60x5.5	90	2362	888	199,658	5,809	5,329	6,661	7,461	7,993	8,366	10,658	15,987	5,329
M64x6	95	2676	1,006	226,196	7,019	6,440	8,050	9,016	9,660	10,110	12,879	19,319	6,440
M68x6	100	3055	1,149	258,258	8,515	7,812	9,765	10,937	11,718	12,265	15,624	23,436	7,812
M72x6	105	3460	1,301	292,445	10,210	9,367	11,708	13,113	14,050	14,706	18,733	28,100	9,367
M76x6	110	3889	1,462	328,757	12,115	11,115	13,893	15,560	16,672	17,450	22,229	33,344	11,115
M80x6	115	4344	1,633	367,193	14,243	13,067	16,334	18,294	19,601	20,516	26,135	39,202	13,067
M90x6	130	5591	2,102	472,576	20,623	18,920	23,650	26,488	28,380	29,704	37,840	56,760	18,920
M100x6	145	6995	2,630	591,237	28,668	26,301	32,876	36,821	39,451	41,292	52,601	78,902	26,301
M110x6	155	8556	3,217	723,174	38,571	35,387	44,233	49,541	53,080	55,557	70,773	106,160	35,387
M125x6	180	11192	4,208	945,976	57,335	52,601	65,751	73,641	78,901	82,584	105,202	157,803	52,601

TORQUE GUIDE FOR ISO R898 **CLASS 10.9**
MINIMUM YIELD 940 ***136338 p.s.i.***
BOLT LOAD BASED ON **50** PERCENT YIELD

REQUIRED TORQUE (N-m)
(To convert to ft/lbs multiply these torque values x .7376)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	BOLT LOAD (LBS)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPH. K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPH. K=.150	API SA2 K=.157	MACH'NE OIL K=.200	DRY STEEL K=.300 K=.300	PLUG IN (K) K=.300 0.1
M20x2.5	30	245	115	25,865	251	230	288	322	345	361	460	690	230
M22x2.5	32	303	143	32,058	342	314	392	439	471	493	627	941	314
M24x3	36	353	166	37,246	433	398	497	557	596	624	795	1,193	398
M27x3	41	459	216	48,541	635	583	729	816	875	915	1,166	1,749	583
M30x3.5	46	561	263	59,233	862	790	988	1,107	1,186	1,241	1,581	2,371	790
M33x3.5	50	694	326	73,282	1,173	1,076	1,345	1,506	1,614	1,689	2,152	3,227	1,076
M36x4	55	817	384	86,296	1,506	1,382	1,727	1,935	2,073	2,170	2,764	4,146	1,382
M39x4	60	976	459	103,099	1,950	1,789	2,236	2,504	2,683	2,808	3,577	5,366	1,789
M42x4.5	65	1121	527	118,437	2,412	2,213	2,766	3,098	3,319	3,474	4,426	6,638	2,213
M45x4.5	70	1306	614	137,993	3,011	2,762	3,453	3,867	4,143	4,337	5,525	8,287	2,762
M48x5	75	1473	692	155,654	3,623	3,324	4,154	4,653	4,985	5,218	6,647	9,971	3,324
M52x5	80	1758	826	185,734	4,683	4,296	5,370	6,015	6,445	6,745	8,593	12,889	4,296
M56x5.5	85	2030	954	214,493	5,824	5,343	6,679	7,481	8,015	8,389	10,686	16,030	5,343
M60x5.5	90	2362	1,110	249,572	7,261	6,661	8,326	9,326	9,992	10,458	13,322	19,984	6,661
M64x6	95	2676	1,258	282,745	8,774	8,050	10,062	11,270	12,074	12,638	16,099	24,149	8,050
M68x6	100	3055	1,436	322,823	10,644	9,765	12,206	13,671	14,648	15,331	19,530	29,295	9,765
M72x6	105	3460	1,626	365,557	12,762	11,708	14,635	16,392	17,562	18,382	23,416	35,125	11,708
M76x6	110	3889	1,828	410,946	15,144	13,893	17,366	19,450	20,840	21,812	27,786	41,680	13,893
M80x6	115	4344	2,042	458,991	17,804	16,334	20,418	22,868	24,501	25,645	32,668	49,003	16,334
M90x6	130	5591	2,628	590,720	25,778	23,650	29,562	33,110	35,475	37,130	47,300	70,949	23,650
M100x6	145	6995	3,288	739,046	35,835	32,876	41,095	46,026	49,314	51,615	65,751	98,627	32,876
M110x6	155	8556	4,021	903,968	48,214	44,233	55,292	61,927	66,350	69,446	88,467	132,700	44,233
M125x6	180	11192	5,260	1,182,470	71,669	65,751	82,189	92,052	98,627	103,229	131,502	197,254	65,751

TORQUE GUIDE FOR ISO R898 **CLASS 10.9**
MINIMUM YIELD 940 ***136338 p.s.i.***
BOLT LOAD BASED ON **60** PERCENT YIELD

REQUIRED TORQUE (N-m)
(To convert to ft/lbs multiply these torque values x .7376)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	BOLT LOAD (LBS)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPH. K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPH. K=.150	API SA2 K=.157	MACH'NE OIL K=.200	DRY STEEL K=.300 K=.300	PLUG IN (K) K=.300 0.1
M20x2.5	30	245	138	31,039	301	276	345	387	414	434	552	828	276
M22x2.5	32	303	171	38,469	410	376	471	527	565	591	753	1,129	376
M24x3	36	353	199	44,696	520	477	596	668	716	749	954	1,432	477
M27x3	41	459	259	58,250	763	700	875	979	1,049	1,098	1,399	2,099	700
M30x3.5	46	561	316	71,079	1,034	949	1,186	1,328	1,423	1,489	1,897	2,846	949
M33x3.5	50	694	391	87,938	1,407	1,291	1,614	1,807	1,936	2,027	2,582	3,873	1,291
M36x4	55	817	461	103,555	1,808	1,658	2,073	2,322	2,488	2,604	3,317	4,975	1,658
M39x4	60	976	550	123,719	2,340	2,146	2,683	3,005	3,220	3,370	4,293	6,439	2,146
M42x4.5	65	1121	632	142,124	2,894	2,655	3,319	3,717	3,983	4,169	5,311	7,966	2,655
M45x4.5	70	1306	737	165,592	3,613	3,315	4,143	4,641	4,972	5,204	6,630	9,944	3,315
M48x5	75	1473	831	186,785	4,347	3,988	4,985	5,584	5,982	6,262	7,977	11,965	3,988
M52x5	80	1758	991	222,881	5,620	5,156	6,445	7,218	7,733	8,094	10,311	15,467	5,156
M56x5.5	85	2030	1,145	257,392	6,989	6,412	8,015	8,977	9,618	10,067	12,824	19,236	6,412
M60x5.5	90	2362	1,332	299,486	8,713	7,993	9,992	11,191	11,990	12,550	15,987	23,980	7,993
M64x6	95	2676	1,509	339,293	10,529	9,660	12,074	13,523	14,489	15,166	19,319	28,979	9,660
M68x6	100	3055	1,723	387,388	12,773	11,718	14,648	16,405	17,577	18,397	23,436	35,154	11,718
M72x6	105	3460	1,951	438,668	15,314	14,050	17,562	19,670	21,075	22,058	28,100	42,150	14,050
M76x6	110	3889	2,194	493,135	18,172	16,672	20,840	23,341	25,008	26,175	33,344	50,016	16,672
M80x6	115	4344	2,450	550,789	21,365	19,601	24,501	27,441	29,402	30,774	39,202	58,803	19,601
M90x6	130	5591	3,153	708,864	30,934	28,380	35,475	39,732	42,570	44,556	56,760	85,139	28,380
M100x6	145	6995	3,945	886,855	43,001	39,451	49,314	55,231	59,176	61,938	78,902	118,353	39,451
M110x6	155	8556	4,825	1,084,762	57,857	53,080	66,350	74,312	79,620	83,336	106,160	159,240	53,080
M125x6	180	11192	6,312	1,418,964	86,003	78,901	98,627	110,462	118,352	123,875	157,803	236,704	78,901

TORQUE GUIDE FOR ISO R898 **CLASS 10.9**

MINIMUM YIELD 940 ***136338 p.s.i.***

BOLT LOAD BASED ON **70** PERCENT YIELD

REQUIRED TORQUE (N-m)

(To convert to ft/lbs multiply these torque values x .7376)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	BOLT LOAD (LBS)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPH. K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPH. K=.150	API SA2 K=.157	MACH'NE OIL K=.200	DRY STEEL K=.300 K=.300	PLUG IN (K) K=.300 0.1
M20x2.5	30	245	161	36,212	351	322	403	451	483	506	644	967	322
M22x2.5	32	303	200	44,881	479	439	549	615	659	690	878	1,318	439
M24x3	36	353	232	52,145	607	557	696	779	835	874	1,113	1,670	557
M27x3	41	459	302	67,958	890	816	1,020	1,143	1,224	1,281	1,632	2,449	816
M30x3.5	46	561	369	82,926	1,206	1,107	1,383	1,549	1,660	1,737	2,213	3,320	1,107
M33x3.5	50	694	456	102,594	1,642	1,506	1,883	2,108	2,259	2,365	3,012	4,518	1,506
M36x4	55	817	537	120,814	2,109	1,935	2,418	2,709	2,902	3,038	3,870	5,804	1,935
M39x4	60	976	642	144,338	2,729	2,504	3,130	3,506	3,756	3,931	5,008	7,512	2,504
M42x4.5	65	1121	738	165,811	3,377	3,098	3,872	4,337	4,647	4,864	6,196	9,294	3,098
M45x4.5	70	1306	859	193,191	4,215	3,867	4,834	5,414	5,801	6,072	7,735	11,602	3,867
M48x5	75	1473	969	217,916	5,072	4,653	5,816	6,514	6,980	7,305	9,306	13,959	4,653
M52x5	80	1758	1,157	260,027	6,556	6,015	7,519	8,421	9,022	9,443	12,030	18,045	6,015
M56x5.5	85	2030	1,336	300,290	8,154	7,481	9,351	10,473	11,221	11,744	14,961	22,442	7,481
M60x5.5	90	2362	1,554	349,401	10,165	9,326	11,657	13,056	13,988	14,641	18,651	27,977	9,326
M64x6	95	2676	1,761	395,842	12,284	11,270	14,087	15,777	16,904	17,693	22,539	33,809	11,270
M68x6	100	3055	2,010	451,952	14,902	13,671	17,089	19,140	20,507	21,464	27,342	41,013	13,671
M72x6	105	3460	2,277	511,780	17,867	16,392	20,489	22,948	24,587	25,735	32,783	49,175	16,392
M76x6	110	3889	2,559	575,325	21,201	19,450	24,313	27,231	29,176	30,537	38,901	58,351	19,450
M80x6	115	4344	2,858	642,587	24,926	22,868	28,585	32,015	34,302	35,903	45,736	68,604	22,868
M90x6	130	5591	3,679	827,008	36,090	33,110	41,387	46,354	49,665	51,982	66,220	99,329	33,110
M100x6	145	6995	4,603	1,034,664	50,168	46,026	57,532	64,436	69,039	72,261	92,052	138,078	46,026
M110x6	155	8556	5,630	1,265,555	67,500	61,927	77,408	86,697	92,890	97,225	123,853	185,780	61,927
M125x6	180	11192	7,364	1,655,458	100,336	92,052	115,065	128,872	138,078	144,521	184,103	276,155	92,052

TORQUE GUIDE FOR ISO R898 **CLASS 10.9**

MINIMUM YIELD 940 ***136338 p.s.i.***

BOLT LOAD BASED ON **80** PERCENT YIELD

REQUIRED TORQUE (N-m)

(To convert to ft/lbs multiply these torque values x .7376)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	BOLT LOAD (LBS)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPH. K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPH. K=.150	API SA2 K=.157	MACH'NE OIL K=.200	DRY STEEL K=.300 K=.300	PLUG IN (K) K=.300 0.1
M20x2.5	30	245	184	41,385	401	368	460	515	552	578	736	1,105	368
M22x2.5	32	303	228	51,292	547	502	627	703	753	788	1,004	1,506	502
M24x3	36	353	265	59,594	693	636	795	891	954	999	1,272	1,909	636
M27x3	41	459	345	77,666	1,017	933	1,166	1,306	1,399	1,465	1,866	2,798	933
M30x3.5	46	561	422	94,772	1,379	1,265	1,581	1,771	1,897	1,986	2,530	3,794	1,265
M33x3.5	50	694	522	117,251	1,876	1,721	2,152	2,410	2,582	2,702	3,442	5,164	1,721
M36x4	55	817	614	138,074	2,410	2,211	2,764	3,096	3,317	3,471	4,422	6,633	2,211
M39x4	60	976	734	164,958	3,119	2,862	3,577	4,007	4,293	4,493	5,724	8,585	2,862
M42x4.5	65	1121	843	189,499	3,859	3,540	4,426	4,957	5,311	5,559	7,081	10,621	3,540
M45x4.5	70	1306	982	220,789	4,817	4,420	5,525	6,188	6,630	6,939	8,839	13,259	4,420
M48x5	75	1473	1,108	249,047	5,796	5,318	6,647	7,445	7,977	8,349	10,635	15,953	5,318
M52x5	80	1758	1,322	297,174	7,493	6,874	8,593	9,624	10,311	10,792	13,748	20,622	6,874
M56x5.5	85	2030	1,527	343,189	9,319	8,549	10,686	11,969	12,824	13,422	17,098	25,648	8,549
M60x5.5	90	2362	1,776	399,315	11,617	10,658	13,322	14,921	15,987	16,733	21,316	31,974	10,658
M64x6	95	2676	2,012	452,391	14,039	12,879	16,099	18,031	19,319	20,221	25,759	38,638	12,879
M68x6	100	3055	2,298	516,517	17,030	15,624	19,530	21,874	23,436	24,530	31,248	46,873	15,624
M72x6	105	3460	2,602	584,891	20,419	18,733	23,416	26,226	28,100	29,411	37,466	56,199	18,733
M76x6	110	3889	2,925	657,514	24,230	22,229	27,786	31,121	33,344	34,900	44,458	66,687	22,229
M80x6	115	4344	3,267	734,385	28,487	26,135	32,668	36,589	39,202	41,031	52,269	78,404	26,135
M90x6	130	5591	4,204	945,152	41,245	37,840	47,300	52,976	56,760	59,408	75,679	113,519	37,840
M100x6	145	6995	5,260	1,182,473	57,335	52,601	65,751	73,642	78,902	82,584	105,202	157,803	52,601
M110x6	155	8556	6,434	1,446,349	77,143	70,773	88,467	99,083	106,160	111,114	141,547	212,320	70,773
M125x6	180	11192	8,416	1,891,951	114,670	105,202	131,502	147,283	157,803	165,167	210,404	315,606	105,202

TORQUE GUIDE FOR ISO R898 **CLASS 10.9**

MINIMUM YIELD 940 ***136338 p.s.i.***

BOLT LOAD BASED ON **90** PERCENT YIELD

REQUIRED TORQUE (N-m)

(To convert to ft/lbs multiply these torque values x .7376)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	BOLT LOAD (LBS)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPH. K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPH. K=.150	API SA2 K=.157	MACH'NE OIL K=.200	DRY STEEL K=.300 K=.300	PLUG IN (K) K=.300 0.1
M20x2.5	30	245	207	46,558	451	414	518	580	621	650	828	1,243	414
M22x2.5	32	303	257	57,704	616	565	706	791	847	887	1,129	1,694	565
M24x3	36	353	298	67,043	780	716	895	1,002	1,074	1,124	1,432	2,147	716
M27x3	41	459	389	87,375	1,144	1,049	1,312	1,469	1,574	1,648	2,099	3,148	1,049
M30x3.5	46	561	474	106,619	1,551	1,423	1,779	1,992	2,134	2,234	2,846	4,269	1,423
M33x3.5	50	694	587	131,907	2,111	1,936	2,420	2,711	2,905	3,040	3,873	5,809	1,936
M36x4	55	817	691	155,333	2,711	2,488	3,109	3,483	3,731	3,905	4,975	7,463	2,488
M39x4	60	976	826	185,578	3,509	3,220	4,024	4,507	4,829	5,055	6,439	9,659	3,220
M42x4.5	65	1121	948	213,186	4,341	3,983	4,979	5,576	5,975	6,253	7,966	11,949	3,983
M45x4.5	70	1306	1,105	248,388	5,420	4,972	6,215	6,961	7,458	7,806	9,944	14,917	4,972
M48x5	75	1473	1,246	280,178	6,521	5,982	7,478	8,375	8,974	9,392	11,965	17,947	5,982
M52x5	80	1758	1,487	334,321	8,429	7,733	9,667	10,827	11,600	12,141	15,467	23,200	7,733
M56x5.5	85	2030	1,717	386,087	10,483	9,618	12,022	13,465	14,427	15,100	19,236	28,854	9,618
M60x5.5	90	2362	1,998	449,230	13,069	11,990	14,988	16,786	17,985	18,824	23,980	35,970	11,990
M64x6	95	2676	2,264	508,940	15,793	14,489	18,112	20,285	21,734	22,748	28,979	43,468	14,489
M68x6	100	3055	2,585	581,081	19,159	17,577	21,971	24,608	26,366	27,596	35,154	52,732	17,577
M72x6	105	3460	2,927	658,002	22,972	21,075	26,344	29,505	31,612	33,087	42,150	63,224	21,075
M76x6	110	3889	3,290	739,703	27,258	25,008	31,260	35,011	37,512	39,262	50,016	75,023	25,008
M80x6	115	4344	3,675	826,183	32,048	29,402	36,752	41,162	44,102	46,160	58,803	88,205	29,402
M90x6	130	5591	4,730	1,063,296	46,401	42,570	53,212	59,598	63,855	66,834	85,139	127,709	42,570
M100x6	145	6995	5,918	1,330,283	64,502	59,176	73,970	82,847	88,764	92,907	118,353	177,529	59,176
M110x6	155	8556	7,238	1,627,142	86,786	79,620	99,525	111,468	119,430	125,003	159,240	238,860	79,620
M125x6	180	11192	9,468	2,128,445	129,004	118,352	147,940	165,693	177,528	185,813	236,704	355,057	118,352

TORQUE GUIDE FOR ISO R898 **CLASS 10.9**

MINIMUM YIELD 940 ***136338 p.s.i.***

BOLT LOAD BASED ON **99** PERCENT YIELD

REQUIRED TORQUE (N-m)

(To convert to ft/lbs multiply these torque values x .7376)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	BOLT LOAD (LBS)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPH. K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPH. K=.150	API SA2 K=.157	MACH'NE OIL K=.200	DRY STEEL K=.300 K=.300	PLUG IN (K) K=.300 0.1
M20x2.5	30	245	228	51,214	497	456	570	638	683	715	911	1,367	456
M22x2.5	32	303	282	63,474	677	621	776	870	932	975	1,242	1,864	621
M24x3	36	353	328	73,748	858	787	984	1,102	1,181	1,236	1,575	2,362	787
M27x3	41	459	428	96,112	1,258	1,154	1,443	1,616	1,732	1,812	2,309	3,463	1,154
M30x3.5	46	561	522	117,280	1,706	1,565	1,956	2,191	2,348	2,457	3,130	4,695	1,565
M33x3.5	50	694	645	145,098	2,322	2,130	2,662	2,982	3,195	3,344	4,260	6,390	2,130
M36x4	55	817	760	170,866	2,983	2,736	3,420	3,831	4,104	4,296	5,473	8,209	2,736
M39x4	60	976	908	204,136	3,860	3,542	4,427	4,958	5,312	5,560	7,083	10,625	3,542
M42x4.5	65	1121	1,043	234,504	4,776	4,381	5,477	6,134	6,572	6,879	8,763	13,144	4,381
M45x4.5	70	1306	1,215	273,227	5,962	5,469	6,837	7,657	8,204	8,587	10,939	16,408	5,469
M48x5	75	1473	1,371	308,196	7,173	6,581	8,226	9,213	9,871	10,332	13,161	19,742	6,581
M52x5	80	1758	1,636	367,753	9,272	8,507	10,633	11,909	12,760	13,356	17,013	25,520	8,507
M56x5.5	85	2030	1,889	424,696	11,532	10,580	13,225	14,811	15,869	16,610	21,159	31,739	10,580
M60x5.5	90	2362	2,198	494,152	14,376	13,189	16,486	18,465	19,784	20,707	26,378	39,567	13,189
M64x6	95	2676	2,490	559,834	17,373	15,938	19,923	22,314	23,908	25,023	31,877	47,815	15,938
M68x6	100	3055	2,843	639,189	21,075	19,335	24,169	27,069	29,002	30,356	38,670	58,005	19,335
M72x6	105	3460	3,220	723,802	25,269	23,182	28,978	32,455	34,773	36,396	46,365	69,547	23,182
M76x6	110	3889	3,620	813,673	29,984	27,509	34,386	38,512	41,263	43,188	55,017	82,526	27,509
M80x6	115	4344	4,043	908,802	35,252	32,342	40,427	45,278	48,513	50,776	64,683	97,025	32,342
M90x6	130	5591	5,203	1,169,626	51,041	46,827	58,533	65,557	70,240	73,518	93,653	140,480	46,827
M100x6	145	6995	6,509	1,463,311	70,952	65,094	81,367	91,131	97,641	102,197	130,188	195,282	65,094
M110x6	155	8556	7,962	1,789,857	95,464	87,582	109,477	122,615	131,373	137,504	175,164	262,746	87,582
M125x6	180	11192	10,415	2,341,290	141,904	130,187	162,734	182,262	195,281	204,394	260,375	390,562	130,187

BOLT LOAD METRIC (GRADE 12.9)
40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR ISO R898 GRADE 12.9

MINIMUM YIELD (Mpa) **1100**

BOLT LOAD BASED ON **40** PERCENT YIELD

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300 K=.300	CUSTOM (INSERT K) 0.157
M20x2.5	30	245	107.72	235	215	269	302	323	338	431	646	338
M22x2.5	32	303	133.50	320	294	367	411	441	461	587	881	461
M24x3	36	353	155.11	406	372	465	521	558	584	745	1,117	584
M27x3	41	459	202.15	595	546	682	764	819	857	1,092	1,637	857
M30x3.5	46	561	246.67	807	740	925	1,036	1,110	1,162	1,480	2,220	1,162
M33x3.5	50	694	305.18	1,098	1,007	1,259	1,410	1,511	1,581	2,014	3,021	1,581
M36x4	55	817	359.38	1,410	1,294	1,617	1,811	1,941	2,031	2,588	3,881	2,031
M39x4	60	976	429.35	1,825	1,674	2,093	2,344	2,512	2,629	3,349	5,023	2,629
M42x4.5	65	1121	493.22	2,258	2,072	2,589	2,900	3,107	3,252	4,143	6,215	3,252
M45x4.5	70	1306	574.67	2,819	2,586	3,233	3,620	3,879	4,060	5,172	7,758	4,060
M48x5	75	1473	648.22	3,391	3,111	3,889	4,356	4,667	4,885	6,223	9,334	4,885
M52x5	80	1758	773.48	4,384	4,022	5,028	5,631	6,033	6,315	8,044	12,066	6,315
M56x5.5	85	2030	893.25	5,452	5,002	6,253	7,003	7,503	7,853	10,004	15,007	7,853
M60x5.5	90	2362	1,039.33	6,797	6,236	7,795	8,730	9,354	9,791	12,472	18,708	9,791
M64x6	95	2676	1,177.48	8,214	7,536	9,420	10,550	11,304	11,831	15,072	22,608	11,831
M68x6	100	3055	1,344.38	9,965	9,142	11,427	12,799	13,713	14,353	18,284	27,425	14,353
M72x6	105	3460	1,522.35	11,947	10,961	13,701	15,345	16,441	17,209	21,922	32,883	17,209
M76x6	110	3889	1,711.37	14,177	13,006	16,258	18,209	19,510	20,420	26,013	39,019	20,420
M80x6	115	4344	1,911.45	16,668	15,292	19,114	21,408	22,937	24,008	30,583	45,875	24,008
M90x6	130	5591	2,460.03	24,133	22,140	27,675	30,996	33,210	34,760	44,281	66,421	34,760
M100x6	145	6995	3,077.73	33,547	30,777	38,472	43,088	46,166	48,320	61,555	92,332	48,320
M110x6	155	8556	3,764.54	45,137	41,410	51,762	57,974	62,115	65,014	82,820	124,230	65,014
M125x6	180	11192	4,924.35	67,094	61,554	76,943	86,176	92,331	96,640	123,109	184,663	96,640

TORQUE GUIDE FOR ISO R898 GRADE 12.9						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			1100									
BOLT LOAD BASED ON			50	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300 K=.300	CUSTOM (INSERT K) 0.157
M20x2.5	30	245	134.64	294	269	337	377	404	423	539	808	423
M22x2.5	32	303	166.88	400	367	459	514	551	576	734	1,101	576
M24x3	36	353	193.89	507	465	582	651	698	731	931	1,396	731
M27x3	41	459	252.69	744	682	853	955	1,023	1,071	1,365	2,047	1,071
M30x3.5	46	561	308.34	1,008	925	1,156	1,295	1,388	1,452	1,850	2,775	1,452
M33x3.5	50	694	381.47	1,372	1,259	1,574	1,762	1,888	1,976	2,518	3,777	1,976
M36x4	55	817	449.22	1,763	1,617	2,021	2,264	2,426	2,539	3,234	4,852	2,539
M39x4	60	976	536.69	2,281	2,093	2,616	2,930	3,140	3,286	4,186	6,279	3,286
M42x4.5	65	1121	616.53	2,822	2,589	3,237	3,625	3,884	4,065	5,179	7,768	4,065
M45x4.5	70	1306	718.33	3,523	3,233	4,041	4,526	4,849	5,075	6,465	9,698	5,075
M48x5	75	1473	810.27	4,239	3,889	4,862	5,445	5,834	6,106	7,779	11,668	6,106
M52x5	80	1758	966.85	5,480	5,028	6,285	7,039	7,541	7,893	10,055	15,083	7,893
M56x5.5	85	2030	1,116.56	6,815	6,253	7,816	8,754	9,379	9,817	12,505	18,758	9,817
M60x5.5	90	2362	1,299.17	8,497	7,795	9,744	10,913	11,692	12,238	15,590	23,385	12,238
M64x6	95	2676	1,471.85	10,268	9,420	11,775	13,188	14,130	14,789	18,840	28,259	14,789
M68x6	100	3055	1,680.48	12,456	11,427	14,284	15,998	17,141	17,941	22,855	34,282	17,941
M72x6	105	3460	1,902.93	14,934	13,701	17,126	19,182	20,552	21,511	27,402	41,103	21,511
M76x6	110	3889	2,139.21	17,721	16,258	20,322	22,761	24,387	25,525	32,516	48,774	25,525
M80x6	115	4344	2,389.31	20,835	19,114	23,893	26,760	28,672	30,010	38,229	57,343	30,010
M90x6	130	5591	3,075.04	30,166	27,675	34,594	38,745	41,513	43,450	55,351	83,026	43,450
M100x6	145	6995	3,847.16	41,934	38,472	48,089	53,860	57,707	60,400	76,943	115,415	60,400
M110x6	155	8556	4,705.67	56,421	51,762	64,703	72,467	77,644	81,267	103,525	155,287	81,267
M125x6	180	11192	6,155.43	83,868	76,943	96,179	107,720	115,414	120,800	153,886	230,829	120,800

TORQUE GUIDE FOR ISO R898 GRADE 12.9						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			1100									
BOLT LOAD BASED ON			60	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300 K=.300	CUSTOM (INSERT K) 0.157
M20x2.5	30	245	161.57	352	323	404	452	485	507	646	969	507
M22x2.5	32	303	200.25	480	441	551	617	661	692	881	1,322	692
M24x3	36	353	232.67	609	558	698	782	838	877	1,117	1,675	877
M27x3	41	459	303.22	892	819	1,023	1,146	1,228	1,285	1,637	2,456	1,285
M30x3.5	46	561	370.01	1,210	1,110	1,388	1,554	1,665	1,743	2,220	3,330	1,743
M33x3.5	50	694	457.77	1,647	1,511	1,888	2,115	2,266	2,372	3,021	4,532	2,372
M36x4	55	817	539.06	2,115	1,941	2,426	2,717	2,911	3,047	3,881	5,822	3,047
M39x4	60	976	644.03	2,738	2,512	3,140	3,516	3,768	3,943	5,023	7,535	3,943
M42x4.5	65	1121	739.84	3,387	3,107	3,884	4,350	4,661	4,878	6,215	9,322	4,878
M45x4.5	70	1306	862.00	4,228	3,879	4,849	5,431	5,819	6,090	7,758	11,637	6,090
M48x5	75	1473	972.32	5,087	4,667	5,834	6,534	7,001	7,327	9,334	14,001	7,327
M52x5	80	1758	1,160.22	6,576	6,033	7,541	8,446	9,050	9,472	12,066	18,099	9,472
M56x5.5	85	2030	1,339.87	8,179	7,503	9,379	10,505	11,255	11,780	15,007	22,510	11,780
M60x5.5	90	2362	1,559.00	10,196	9,354	11,692	13,096	14,031	14,686	18,708	28,062	14,686
M64x6	95	2676	1,766.22	12,321	11,304	14,130	15,825	16,956	17,747	22,608	33,911	17,747
M68x6	100	3055	2,016.57	14,947	13,713	17,141	19,198	20,569	21,529	27,425	41,138	21,529
M72x6	105	3460	2,283.52	17,921	16,441	20,552	23,018	24,662	25,813	32,883	49,324	25,813
M76x6	110	3889	2,567.05	21,265	19,510	24,387	27,313	29,264	30,630	39,019	58,529	30,630
M80x6	115	4344	2,867.17	25,002	22,937	28,672	32,112	34,406	36,012	45,875	68,812	36,012
M90x6	130	5591	3,690.04	36,199	33,210	41,513	46,495	49,816	52,140	66,421	99,631	52,140
M100x6	145	6995	4,616.59	50,321	46,166	57,707	64,632	69,249	72,480	92,332	138,498	72,480
M110x6	155	8556	5,646.81	67,705	62,115	77,644	86,961	93,172	97,520	124,230	186,345	97,520
M125x6	180	11192	7,386.52	100,641	92,331	115,414	129,264	138,497	144,960	184,663	276,994	144,960

TORQUE GUIDE FOR ISO R898 GRADE 12.9						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			1100									
BOLT LOAD BASED ON			70	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300 K=.300	CUSTOM (INSERT K) 0.157
M20x2.5	30	245	188.50	411	377	471	528	566	592	754	1,131	592
M22x2.5	32	303	233.63	560	514	642	720	771	807	1,028	1,542	807
M24x3	36	353	271.44	710	651	814	912	977	1,023	1,303	1,954	1,023
M27x3	41	459	353.76	1,041	955	1,194	1,337	1,433	1,500	1,910	2,865	1,500
M30x3.5	46	561	431.68	1,412	1,295	1,619	1,813	1,943	2,033	2,590	3,885	2,033
M33x3.5	50	694	534.06	1,921	1,762	2,203	2,467	2,644	2,767	3,525	5,287	2,767
M36x4	55	817	628.91	2,468	2,264	2,830	3,170	3,396	3,555	4,528	6,792	3,555
M39x4	60	976	751.36	3,194	2,930	3,663	4,102	4,395	4,601	5,861	8,791	4,601
M42x4.5	65	1121	863.14	3,951	3,625	4,531	5,075	5,438	5,692	7,250	10,876	5,692
M45x4.5	70	1306	1,005.67	4,933	4,526	5,657	6,336	6,788	7,105	9,051	13,577	7,105
M48x5	75	1473	1,134.38	5,935	5,445	6,806	7,623	8,168	8,549	10,890	16,335	8,549
M52x5	80	1758	1,353.59	7,672	7,039	8,798	9,854	10,558	11,051	14,077	21,116	11,051
M56x5.5	85	2030	1,563.18	9,542	8,754	10,942	12,255	13,131	13,744	17,508	26,261	13,744
M60x5.5	90	2362	1,818.83	11,895	10,913	13,641	15,278	16,369	17,133	21,826	32,739	17,133
M64x6	95	2676	2,060.59	14,375	13,188	16,485	18,463	19,782	20,705	26,376	39,563	20,705
M68x6	100	3055	2,352.67	17,438	15,998	19,998	22,397	23,997	25,117	31,996	47,994	25,117
M72x6	105	3460	2,664.11	20,908	19,182	23,977	26,854	28,772	30,115	38,363	57,545	30,115
M76x6	110	3889	2,994.89	24,810	22,761	28,451	31,866	34,142	35,735	45,522	68,284	35,735
M80x6	115	4344	3,345.03	29,169	26,760	33,450	37,464	40,140	42,014	53,521	80,281	42,014
M90x6	130	5591	4,305.05	42,233	38,745	48,432	54,244	58,118	60,830	77,491	116,236	60,830
M100x6	145	6995	5,386.02	58,708	53,860	67,325	75,404	80,790	84,561	107,720	161,581	84,561
M110x6	155	8556	6,587.94	78,989	72,467	90,584	101,454	108,701	113,774	144,935	217,402	113,774
M125x6	180	11192	8,617.60	117,415	107,720	134,650	150,808	161,580	169,120	215,440	323,160	169,120

TORQUE GUIDE FOR ISO R898 GRADE 12.9						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			1100									
BOLT LOAD BASED ON			80	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300 K=.300	CUSTOM (INSERT K) 0.157
M20x2.5	30	245	215.43	470	431	539	603	646	676	862	1,293	676
M22x2.5	32	303	267.01	640	587	734	822	881	922	1,175	1,762	922
M24x3	36	353	310.22	812	745	931	1,042	1,117	1,169	1,489	2,234	1,169
M27x3	41	459	404.30	1,190	1,092	1,365	1,528	1,637	1,714	2,183	3,275	1,714
M30x3.5	46	561	493.34	1,613	1,480	1,850	2,072	2,220	2,324	2,960	4,440	2,324
M33x3.5	50	694	610.36	2,195	2,014	2,518	2,820	3,021	3,162	4,028	6,043	3,162
M36x4	55	817	718.75	2,820	2,588	3,234	3,623	3,881	4,062	5,175	7,763	4,062
M39x4	60	976	858.70	3,650	3,349	4,186	4,689	5,023	5,258	6,698	10,047	5,258
M42x4.5	65	1121	986.45	4,516	4,143	5,179	5,800	6,215	6,505	8,286	12,429	6,505
M45x4.5	70	1306	1,149.34	5,637	5,172	6,465	7,241	7,758	8,120	10,344	15,516	8,120
M48x5	75	1473	1,296.43	6,783	6,223	7,779	8,712	9,334	9,770	12,446	18,669	9,770
M52x5	80	1758	1,546.96	8,768	8,044	10,055	11,262	12,066	12,629	16,088	24,133	12,629
M56x5.5	85	2030	1,786.49	10,905	10,004	12,505	14,006	15,007	15,707	20,009	30,013	15,707
M60x5.5	90	2362	2,078.66	13,594	12,472	15,590	17,461	18,708	19,581	24,944	37,416	19,581
M64x6	95	2676	2,354.96	16,428	15,072	18,840	21,100	22,608	23,663	30,143	45,215	23,663
M68x6	100	3055	2,688.77	19,929	18,284	22,855	25,597	27,425	28,705	36,567	54,851	28,705
M72x6	105	3460	3,044.69	23,895	21,922	27,402	30,690	32,883	34,417	43,844	65,765	34,417
M76x6	110	3889	3,422.74	28,354	26,013	32,516	36,418	39,019	40,840	52,026	78,038	40,840
M80x6	115	4344	3,822.90	33,336	30,583	38,229	42,816	45,875	48,016	61,166	91,750	48,016
M90x6	130	5591	4,920.06	48,266	44,281	55,351	61,993	66,421	69,520	88,561	132,842	69,520
M100x6	145	6995	6,155.45	67,094	61,555	76,943	86,176	92,332	96,641	123,109	184,664	96,641
M110x6	155	8556	7,529.07	90,274	82,820	103,525	115,948	124,230	130,027	165,640	248,459	130,027
M125x6	180	11192	9,848.69	134,188	123,109	153,886	172,352	184,663	193,281	246,217	369,326	193,281

TORQUE GUIDE FOR ISO R898 GRADE 12.9						REQUIRED TORQUE (N-m)						
MINIMUM YIELD (Mpa)			**1100**									
BOLT LOAD BASED ON			**90**	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300 K=.300	CUSTOM (INSERT K) 0.157
M20x2.5	30	245	242.36	528	485	606	679	727	761	969	1,454	761
M22x2.5	32	303	300.38	720	661	826	925	991	1,038	1,322	1,983	1,038
M24x3	36	353	349.00	913	838	1,047	1,173	1,256	1,315	1,675	2,513	1,315
M27x3	41	459	454.84	1,339	1,228	1,535	1,719	1,842	1,928	2,456	3,684	1,928
M30x3.5	46	561	555.01	1,815	1,665	2,081	2,331	2,498	2,614	3,330	4,995	2,614
M33x3.5	50	694	686.65	2,470	2,266	2,832	3,172	3,399	3,558	4,532	6,798	3,558
M36x4	55	817	808.60	3,173	2,911	3,639	4,075	4,366	4,570	5,822	8,733	4,570
M39x4	60	976	966.04	4,107	3,768	4,709	5,275	5,651	5,915	7,535	11,303	5,915
M42x4.5	65	1121	1,109.75	5,080	4,661	5,826	6,525	6,991	7,318	9,322	13,983	7,318
M45x4.5	70	1306	1,293.00	6,342	5,819	7,273	8,146	8,728	9,135	11,637	17,456	9,135
M48x5	75	1473	1,458.49	7,631	7,001	8,751	9,801	10,501	10,991	14,001	21,002	10,991
M52x5	80	1758	1,740.33	9,864	9,050	11,312	12,670	13,575	14,208	18,099	27,149	14,208
M56x5.5	85	2030	2,009.81	12,268	11,255	14,069	15,757	16,882	17,670	22,510	33,765	17,670
M60x5.5	90	2362	2,338.50	15,294	14,031	17,539	19,643	21,046	22,029	28,062	42,093	22,029
M64x6	95	2676	2,649.33	18,482	16,956	21,195	23,738	25,434	26,620	33,911	50,867	26,620
M68x6	100	3055	3,024.86	22,420	20,569	25,711	28,797	30,854	32,293	41,138	61,707	32,293
M72x6	105	3460	3,425.28	26,882	24,662	30,828	34,527	36,993	38,719	49,324	73,986	38,719
M76x6	110	3889	3,850.58	31,898	29,264	36,580	40,970	43,897	45,945	58,529	87,793	45,945
M80x6	115	4344	4,300.76	37,503	34,406	43,008	48,168	51,609	54,018	68,812	103,218	54,018
M90x6	130	5591	5,535.07	54,299	49,816	62,269	69,742	74,723	78,210	99,631	149,447	78,210
M100x6	145	6995	6,924.88	75,481	69,249	86,561	96,948	103,873	108,721	138,498	207,746	108,721
M110x6	155	8556	8,470.21	101,558	93,172	116,465	130,441	139,758	146,281	186,345	279,517	146,281
M125x6	180	11192	11,079.78	150,962	138,497	173,122	193,896	207,746	217,441	276,994	415,492	217,441

TORQUE GUIDE FOR ISO R898 GRADE 12.9						REQUIRED TORQUE (N-m)						
MINIMUM YIELD (Mpa)			**1100**									
BOLT LOAD BASED ON			**99**	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300 K=.300	CUSTOM (INSERT K) 0.157
M20x2.5	30	245	266.60	581	533	666	746	800	837	1,066	1,600	837
M22x2.5	32	303	330.42	792	727	909	1,018	1,090	1,141	1,454	2,181	1,141
M24x3	36	353	383.90	1,004	921	1,152	1,290	1,382	1,447	1,843	2,764	1,447
M27x3	41	459	500.32	1,472	1,351	1,689	1,891	2,026	2,121	2,702	4,053	2,121
M30x3.5	46	561	610.51	1,996	1,832	2,289	2,564	2,747	2,876	3,663	5,495	2,876
M33x3.5	50	694	755.32	2,717	2,493	3,116	3,490	3,739	3,913	4,985	7,478	3,913
M36x4	55	817	889.46	3,490	3,202	4,003	4,483	4,803	5,027	6,404	9,606	5,027
M39x4	60	976	1,062.64	4,517	4,144	5,180	5,802	6,216	6,507	8,289	12,433	6,507
M42x4.5	65	1121	1,220.73	5,589	5,127	6,409	7,178	7,691	8,049	10,254	15,381	8,049
M45x4.5	70	1306	1,422.30	6,976	6,400	8,000	8,961	9,601	10,049	12,801	19,201	10,049
M48x5	75	1473	1,604.34	8,394	7,701	9,626	10,781	11,551	12,090	15,402	23,102	12,090
M52x5	80	1758	1,914.36	10,851	9,955	12,443	13,937	14,932	15,629	19,909	29,864	15,629
M56x5.5	85	2030	2,210.79	13,495	12,380	15,476	17,333	18,571	19,437	24,761	37,141	19,437
M60x5.5	90	2362	2,572.35	16,823	15,434	19,293	21,608	23,151	24,232	30,868	46,302	24,232
M64x6	95	2676	2,914.26	20,330	18,651	23,314	26,112	27,977	29,282	37,302	55,954	29,282
M68x6	100	3055	3,327.35	24,662	22,626	28,282	31,676	33,939	35,523	45,252	67,878	35,523
M72x6	105	3460	3,767.81	29,570	27,128	33,910	37,979	40,692	42,591	54,256	81,385	42,591
M76x6	110	3889	4,235.64	35,088	32,191	40,239	45,067	48,286	50,540	64,382	96,572	50,540
M80x6	115	4344	4,730.83	41,253	37,847	47,308	52,985	56,770	59,419	75,693	113,540	59,419
M90x6	130	5591	6,088.57	59,729	54,797	68,496	76,716	82,196	86,032	109,594	164,391	86,032
M100x6	145	6995	7,617.37	83,029	76,174	95,217	106,643	114,261	119,593	152,347	228,521	119,593
M110x6	155	8556	9,317.23	111,714	102,490	128,112	143,485	153,734	160,909	204,979	307,469	160,909
M125x6	180	11192	12,187.76	166,058	152,347	190,434	213,286	228,520	239,185	304,694	457,041	239,185

BOLT LOAD (METRIC) SOCKET HEAD CAP SCREWS (MATERIAL 1.1181)

40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

TORQUE GUIDE FOR MATERIAL STANDARD **1.1181**

MINIMUM YIELD (Mpa) 280

BOLT LOAD BASED ON 40 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	27.42	60	55	69	77	82	86	110	241	60
M22x2.5	32	303	33.98	81	75	93	105	112	117	150	329	81
M24x3	36	353	39.48	103	95	118	133	142	149	190	417	103
M27x3	41	459	51.46	151	139	174	195	208	218	278	611	151
M30x3.5	46	561	62.79	205	188	235	264	283	296	377	829	205
M33x3.5	50	694	77.68	279	256	320	359	385	402	513	1,128	279
M36x4	55	817	91.48	359	329	412	461	494	517	659	1,449	359
M39x4	60	976	109.29	465	426	533	597	639	669	852	1,875	465
M42x4.5	65	1121	125.55	575	527	659	738	791	828	1,055	2,320	575
M45x4.5	70	1306	146.28	717	658	823	922	987	1,033	1,317	2,896	717
M48x5	75	1473	165.00	863	792	990	1,109	1,188	1,243	1,584	3,485	863
M52x5	80	1758	196.89	1,116	1,024	1,280	1,433	1,536	1,607	2,048	4,505	1,116
M56x5.5	85	2030	227.37	1,388	1,273	1,592	1,783	1,910	1,999	2,547	5,602	1,388
M60x5.5	90	2362	264.56	1,730	1,587	1,984	2,222	2,381	2,492	3,175	6,984	1,730
M64x6	95	2676	299.72	2,091	1,918	2,398	2,686	2,877	3,012	3,836	8,440	2,091
M68x6	100	3055	342.21	2,536	2,327	2,909	3,258	3,491	3,653	4,654	10,239	2,536
M72x6	105	3460	387.51	3,041	2,790	3,488	3,906	4,185	4,380	5,580	12,276	3,041
M76x6	110	3889	435.62	3,609	3,311	4,138	4,635	4,966	5,198	6,621	14,567	3,609
M80x6	115	4344	486.55	4,243	3,892	4,866	5,449	5,839	6,111	7,785	17,127	4,243
M90x6	130	5591	626.19	6,143	5,636	7,045	7,890	8,454	8,848	11,271	24,797	6,143
M100x6	145	6995	783.42	8,539	7,834	9,793	10,968	11,751	12,300	15,668	34,471	8,539
M110x6	155	8556	958.25	11,489	10,541	13,176	14,757	15,811	16,549	21,081	46,379	11,489
M125x6	180	11192	1,253.47	17,079	15,668	19,585	21,936	23,503	24,599	31,337	68,941	17,079

TORQUE GUIDE FOR MATERIAL STANDARD **1.1181**

MINIMUM YIELD (Mpa) 280

BOLT LOAD BASED ON 50 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	34.27	75	69	86	96	103	108	137	302	75
M22x2.5	32	303	42.48	102	93	117	131	140	147	187	411	102
M24x3	36	353	49.35	129	118	148	166	178	186	237	521	129
M27x3	41	459	64.32	189	174	217	243	260	273	347	764	189
M30x3.5	46	561	78.49	257	235	294	330	353	370	471	1,036	257
M33x3.5	50	694	97.10	349	320	401	449	481	503	641	1,410	349
M36x4	55	817	114.35	449	412	515	576	617	646	823	1,811	449
M39x4	60	976	136.61	581	533	666	746	799	836	1,066	2,344	581
M42x4.5	65	1121	156.94	718	659	824	923	989	1,035	1,318	2,900	718
M45x4.5	70	1306	182.85	897	823	1,029	1,152	1,234	1,292	1,646	3,620	897
M48x5	75	1473	206.25	1,079	990	1,238	1,386	1,485	1,554	1,980	4,356	1,079
M52x5	80	1758	246.11	1,395	1,280	1,600	1,792	1,920	2,009	2,560	5,631	1,395
M56x5.5	85	2030	284.22	1,735	1,592	1,990	2,228	2,387	2,499	3,183	7,003	1,735
M60x5.5	90	2362	330.70	2,163	1,984	2,480	2,778	2,976	3,115	3,968	8,730	2,163
M64x6	95	2676	374.65	2,614	2,398	2,997	3,357	3,597	3,765	4,796	10,550	2,614
M68x6	100	3055	427.76	3,171	2,909	3,636	4,072	4,363	4,567	5,818	12,799	3,171
M72x6	105	3460	484.38	3,801	3,488	4,359	4,883	5,231	5,475	6,975	15,345	3,801
M76x6	110	3889	544.53	4,511	4,138	5,173	5,794	6,208	6,497	8,277	18,209	4,511
M80x6	115	4344	608.19	5,303	4,866	6,082	6,812	7,298	7,639	9,731	21,408	5,303
M90x6	130	5591	782.74	7,679	7,045	8,806	9,862	10,567	11,060	14,089	30,996	7,679
M100x6	145	6995	979.28	10,674	9,793	12,241	13,710	14,689	15,375	19,586	43,088	10,674
M110x6	155	8556	1,197.81	14,362	13,176	16,470	18,446	19,764	20,686	26,352	57,974	14,362
M125x6	180	11192	1,566.84	21,348	19,585	24,482	27,420	29,378	30,749	39,171	86,176	21,348

TORQUE GUIDE FOR MATERIAL STANDARD **1.1181**

MINIMUM YIELD (Mpa) 280

BOLT LOAD BASED ON 60 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	41.13	90	82	103	115	123	129	165	362	90
M22x2.5	32	303	50.97	122	112	140	157	168	176	224	493	122
M24x3	36	353	59.22	155	142	178	199	213	223	284	625	155
M27x3	41	459	77.18	227	208	260	292	313	327	417	917	227
M30x3.5	46	561	94.18	308	283	353	396	424	444	565	1,243	308
M33x3.5	50	694	116.52	419	385	481	538	577	604	769	1,692	419
M36x4	55	817	137.22	538	494	617	692	741	776	988	2,174	538
M39x4	60	976	163.93	697	639	799	895	959	1,004	1,279	2,813	697
M42x4.5	65	1121	188.32	862	791	989	1,107	1,186	1,242	1,582	3,480	862
M45x4.5	70	1306	219.42	1,076	987	1,234	1,382	1,481	1,550	1,975	4,344	1,076
M48x5	75	1473	247.50	1,295	1,188	1,485	1,663	1,782	1,865	2,376	5,227	1,295
M52x5	80	1758	295.33	1,674	1,536	1,920	2,150	2,304	2,411	3,071	6,757	1,674
M56x5.5	85	2030	341.06	2,082	1,910	2,387	2,674	2,865	2,999	3,820	8,404	2,082
M60x5.5	90	2362	396.84	2,595	2,381	2,976	3,333	3,572	3,738	4,762	10,476	2,595
M64x6	95	2676	449.58	3,136	2,877	3,597	4,028	4,316	4,517	5,755	12,660	3,136
M68x6	100	3055	513.31	3,805	3,491	4,363	4,887	5,236	5,480	6,981	15,358	3,805
M72x6	105	3460	581.26	4,562	4,185	5,231	5,859	6,278	6,571	8,370	18,414	4,562
M76x6	110	3889	653.43	5,413	4,966	6,208	6,953	7,449	7,797	9,932	21,851	5,413
M80x6	115	4344	729.83	6,364	5,839	7,298	8,174	8,758	9,167	11,677	25,690	6,364
M90x6	130	5591	939.28	9,214	8,454	10,567	11,835	12,680	13,272	16,907	37,196	9,214
M100x6	145	6995	1,175.13	12,809	11,751	14,689	16,452	17,627	18,450	23,503	51,706	12,809
M110x6	155	8556	1,437.37	17,234	15,811	19,764	22,135	23,717	24,823	31,622	69,569	17,234
M125x6	180	11192	1,880.20	25,618	23,503	29,378	32,904	35,254	36,899	47,005	103,411	25,618

TORQUE GUIDE FOR MATERIAL STANDARD **1.1181**

MINIMUM YIELD (Mpa) 280

BOLT LOAD BASED ON 70 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	47.98	105	96	120	134	144	151	192	422	105
M22x2.5	32	303	59.47	143	131	164	183	196	205	262	576	143
M24x3	36	353	69.09	181	166	207	232	249	260	332	730	181
M27x3	41	459	90.05	265	243	304	340	365	382	486	1,070	265
M30x3.5	46	561	109.88	359	330	412	461	494	518	659	1,450	359
M33x3.5	50	694	135.94	489	449	561	628	673	704	897	1,974	489
M36x4	55	817	160.09	628	576	720	807	864	905	1,153	2,536	628
M39x4	60	976	191.26	813	746	932	1,044	1,119	1,171	1,492	3,282	813
M42x4.5	65	1121	219.71	1,006	923	1,153	1,292	1,384	1,449	1,846	4,060	1,006
M45x4.5	70	1306	255.99	1,256	1,152	1,440	1,613	1,728	1,809	2,304	5,069	1,256
M48x5	75	1473	288.75	1,511	1,386	1,733	1,940	2,079	2,176	2,772	6,098	1,511
M52x5	80	1758	344.55	1,953	1,792	2,240	2,508	2,687	2,813	3,583	7,883	1,953
M56x5.5	85	2030	397.90	2,429	2,228	2,785	3,120	3,342	3,498	4,456	9,804	2,429
M60x5.5	90	2362	462.98	3,028	2,778	3,472	3,889	4,167	4,361	5,556	12,223	3,028
M64x6	95	2676	524.51	3,659	3,357	4,196	4,700	5,035	5,270	6,714	14,770	3,659
M68x6	100	3055	598.86	4,439	4,072	5,090	5,701	6,108	6,393	8,145	17,918	4,439
M72x6	105	3460	678.14	5,322	4,883	6,103	6,836	7,324	7,666	9,765	21,483	5,322
M76x6	110	3889	762.34	6,315	5,794	7,242	8,111	8,691	9,096	11,588	25,493	6,315
M80x6	115	4344	851.46	7,425	6,812	8,515	9,536	10,218	10,694	13,623	29,972	7,425
M90x6	130	5591	1,095.83	10,750	9,862	12,328	13,807	14,794	15,484	19,725	43,395	10,750
M100x6	145	6995	1,370.99	14,944	13,710	17,137	19,194	20,565	21,524	27,420	60,323	14,944
M110x6	155	8556	1,676.93	20,106	18,446	23,058	25,825	27,669	28,961	36,892	81,163	20,106
M125x6	180	11192	2,193.57	29,887	27,420	34,275	38,388	41,129	43,049	54,839	120,646	29,887

TORQUE GUIDE FOR MATERIAL STANDARD **1.1181**

MINIMUM YIELD (Mpa) 280

BOLT LOAD BASED ON 80 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	54.84	120	110	137	154	165	172	219	483	120
M22x2.5	32	303	67.96	163	150	187	209	224	235	299	658	163
M24x3	36	353	78.97	207	190	237	265	284	298	379	834	207
M27x3	41	459	102.91	303	278	347	389	417	436	556	1,223	303
M30x3.5	46	561	125.58	411	377	471	527	565	591	753	1,658	411
M33x3.5	50	694	155.36	559	513	641	718	769	805	1,025	2,256	559
M36x4	55	817	182.96	718	659	823	922	988	1,034	1,317	2,898	718
M39x4	60	976	218.58	929	852	1,066	1,193	1,279	1,338	1,705	3,751	929
M42x4.5	65	1121	251.10	1,150	1,055	1,318	1,476	1,582	1,656	2,109	4,640	1,150
M45x4.5	70	1306	292.56	1,435	1,317	1,646	1,843	1,975	2,067	2,633	5,793	1,435
M48x5	75	1473	330.00	1,727	1,584	1,980	2,218	2,376	2,487	3,168	6,970	1,727
M52x5	80	1758	393.77	2,232	2,048	2,560	2,867	3,071	3,215	4,095	9,010	2,232
M56x5.5	85	2030	454.74	2,776	2,547	3,183	3,565	3,820	3,998	5,093	11,205	2,776
M60x5.5	90	2362	529.11	3,460	3,175	3,968	4,445	4,762	4,984	6,349	13,969	3,460
M64x6	95	2676	599.44	4,182	3,836	4,796	5,371	5,755	6,023	7,673	16,880	4,182
M68x6	100	3055	684.41	5,073	4,654	5,818	6,516	6,981	7,307	9,308	20,478	5,073
M72x6	105	3460	775.01	6,082	5,580	6,975	7,812	8,370	8,761	11,160	24,552	6,082
M76x6	110	3889	871.24	7,217	6,621	8,277	9,270	9,932	10,396	13,243	29,134	7,217
M80x6	115	4344	973.10	8,485	7,785	9,731	10,899	11,677	12,222	15,570	34,253	8,485
M90x6	130	5591	1,252.38	12,286	11,271	14,089	15,780	16,907	17,696	22,543	49,594	12,286
M100x6	145	6995	1,566.84	17,079	15,668	19,586	21,936	23,503	24,599	31,337	68,941	17,079
M110x6	155	8556	1,916.49	22,979	21,081	26,352	29,514	31,622	33,098	42,163	92,758	22,979
M125x6	180	11192	2,506.94	34,157	31,337	39,171	43,871	47,005	49,199	62,673	137,882	34,157

TORQUE GUIDE FOR MATERIAL STANDARD **1.1181**

MINIMUM YIELD (Mpa) 280

BOLT LOAD BASED ON 90 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	61.69	134	123	154	173	185	194	247	543	134
M22x2.5	32	303	76.46	183	168	210	235	252	264	336	740	183
M24x3	36	353	88.84	232	213	267	298	320	335	426	938	232
M27x3	41	459	115.78	341	313	391	438	469	491	625	1,375	341
M30x3.5	46	561	141.28	462	424	530	593	636	665	848	1,865	462
M33x3.5	50	694	174.78	629	577	721	808	865	906	1,154	2,538	629
M36x4	55	817	205.82	808	741	926	1,037	1,111	1,163	1,482	3,260	808
M39x4	60	976	245.90	1,045	959	1,199	1,343	1,439	1,506	1,918	4,220	1,045
M42x4.5	65	1121	282.48	1,293	1,186	1,483	1,661	1,780	1,863	2,373	5,220	1,293
M45x4.5	70	1306	329.13	1,614	1,481	1,851	2,074	2,222	2,325	2,962	6,517	1,614
M48x5	75	1473	371.25	1,942	1,782	2,228	2,495	2,673	2,798	3,564	7,841	1,942
M52x5	80	1758	442.99	2,511	2,304	2,879	3,225	3,455	3,617	4,607	10,136	2,511
M56x5.5	85	2030	511.59	3,123	2,865	3,581	4,011	4,297	4,498	5,730	12,606	3,123
M60x5.5	90	2362	595.25	3,893	3,572	4,464	5,000	5,357	5,607	7,143	15,715	3,893
M64x6	95	2676	674.37	4,704	4,316	5,395	6,042	6,474	6,776	8,632	18,990	4,704
M68x6	100	3055	769.96	5,707	5,236	6,545	7,330	7,854	8,220	10,472	23,037	5,707
M72x6	105	3460	871.89	6,843	6,278	7,847	8,789	9,416	9,856	12,555	27,621	6,843
M76x6	110	3889	980.15	8,120	7,449	9,311	10,429	11,174	11,695	14,898	32,776	8,120
M80x6	115	4344	1,094.74	9,546	8,758	10,947	12,261	13,137	13,750	17,516	38,535	9,546
M90x6	130	5591	1,408.93	13,822	12,680	15,850	17,752	19,020	19,908	25,361	55,793	13,822
M100x6	145	6995	1,762.70	19,213	17,627	22,034	24,678	26,440	27,674	35,254	77,559	19,213
M110x6	155	8556	2,156.05	25,851	23,717	29,646	33,203	35,575	37,235	47,433	104,353	25,851
M125x6	180	11192	2,820.31	38,427	35,254	44,067	49,355	52,881	55,349	70,508	155,117	38,427

TORQUE GUIDE FOR MATERIAL STANDARD **1.1181**

MINIMUM YIELD (Mpa) 280

BOLT LOAD BASED ON 99 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	67.86	148	136	170	190	204	213	271	597	148
M22x2.5	32	303	84.11	202	185	231	259	278	291	370	814	202
M24x3	36	353	97.72	256	235	293	328	352	368	469	1,032	256
M27x3	41	459	127.35	375	344	430	481	516	540	688	1,513	375
M30x3.5	46	561	155.40	508	466	583	653	699	732	932	2,051	508
M33x3.5	50	694	192.26	692	634	793	888	952	996	1,269	2,792	692
M36x4	55	817	226.41	888	815	1,019	1,141	1,223	1,280	1,630	3,586	888
M39x4	60	976	270.49	1,150	1,055	1,319	1,477	1,582	1,656	2,110	4,642	1,150
M42x4.5	65	1121	310.73	1,423	1,305	1,631	1,827	1,958	2,049	2,610	5,742	1,423
M45x4.5	70	1306	362.04	1,776	1,629	2,036	2,281	2,444	2,558	3,258	7,168	1,776
M48x5	75	1473	408.38	2,137	1,960	2,450	2,744	2,940	3,078	3,920	8,625	2,137
M52x5	80	1758	487.29	2,762	2,534	3,167	3,547	3,801	3,978	5,068	11,149	2,762
M56x5.5	85	2030	562.75	3,435	3,151	3,939	4,412	4,727	4,948	6,303	13,866	3,435
M60x5.5	90	2362	654.78	4,282	3,929	4,911	5,500	5,893	6,168	7,857	17,286	4,282
M64x6	95	2676	741.81	5,175	4,748	5,934	6,647	7,121	7,454	9,495	20,889	5,175
M68x6	100	3055	846.96	6,278	5,759	7,199	8,063	8,639	9,042	11,519	25,341	6,278
M72x6	105	3460	959.08	7,527	6,905	8,632	9,668	10,358	10,841	13,811	30,384	7,527
M76x6	110	3889	1,078.16	8,931	8,194	10,243	11,472	12,291	12,865	16,388	36,054	8,931
M80x6	115	4344	1,204.21	10,501	9,634	12,042	13,487	14,451	15,125	19,267	42,388	10,501
M90x6	130	5591	1,549.82	15,204	13,948	17,435	19,528	20,923	21,899	27,897	61,373	15,204
M100x6	145	6995	1,938.97	21,135	19,390	24,237	27,146	29,085	30,442	38,779	85,315	21,135
M110x6	155	8556	2,371.66	28,436	26,088	32,610	36,524	39,132	40,959	52,176	114,788	28,436
M125x6	180	11192	3,102.34	42,269	38,779	48,474	54,291	58,169	60,883	77,558	170,629	42,269

BOLT LOAD (METRIC) SOCKET HEAD CAP SCREWS (MATERIAL 1.1181 Mpa=280)

40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

TORQUE GUIDE FOR MATERIAL STANDARD **1.1181**

MINIMUM YIELD (Mpa) 280

BOLT LOAD BASED ON 40 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	LoaDISC TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	27.42	60	55	69	77	82	86	110	241	60
M22x2.5	32	303	33.98	81	75	93	105	112	117	150	329	81
M24x3	36	353	39.48	103	95	118	133	142	149	190	417	103
M27x3	41	459	51.46	151	139	174	195	208	218	278	611	151
M30x3.5	46	561	62.79	205	188	235	264	283	296	377	829	205
M33x3.5	50	694	77.68	279	256	320	359	385	402	513	1,128	279
M36x4	55	817	91.48	359	329	412	461	494	517	659	1,449	359
M39x4	60	976	109.29	465	426	533	597	639	669	852	1,875	465
M42x4.5	65	1121	125.55	575	527	659	738	791	828	1,055	2,320	575
M45x4.5	70	1306	146.28	717	658	823	922	987	1,033	1,317	2,896	717
M48x5	75	1473	165.00	863	792	990	1,109	1,188	1,243	1,584	3,485	863
M52x5	80	1758	196.89	1,116	1,024	1,280	1,433	1,536	1,607	2,048	4,505	1,116
M56x5.5	85	2030	227.37	1,388	1,273	1,592	1,783	1,910	1,999	2,547	5,602	1,388
M60x5.5	90	2362	264.56	1,730	1,587	1,984	2,222	2,381	2,492	3,175	6,984	1,730
M64x6	95	2676	299.72	2,091	1,918	2,398	2,686	2,877	3,012	3,836	8,440	2,091
M68x6	100	3055	342.21	2,536	2,327	2,909	3,258	3,491	3,653	4,654	10,239	2,536
M72x6	105	3460	387.51	3,041	2,790	3,488	3,906	4,185	4,380	5,580	12,276	3,041
M76x6	110	3889	435.62	3,609	3,311	4,138	4,635	4,966	5,198	6,621	14,567	3,609
M80x6	115	4344	486.55	4,243	3,892	4,866	5,449	5,839	6,111	7,785	17,127	4,243
M90x6	130	5591	626.19	6,143	5,636	7,045	7,890	8,454	8,848	11,271	24,797	6,143
M100x6	145	6995	783.42	8,539	7,834	9,793	10,968	11,751	12,300	15,668	34,471	8,539
M110x6	155	8556	958.25	11,489	10,541	13,176	14,757	15,811	16,549	21,081	46,379	11,489
M125x6	180	11192	1,253.47	17,079	15,668	19,585	21,936	23,503	24,599	31,337	68,941	17,079

TORQUE GUIDE FOR MATERIAL STANDARD **1.1181**

MINIMUM YIELD (Mpa) 280

BOLT LOAD BASED ON 50 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	LoaDISC TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	34.27	75	69	86	96	103	108	137	302	75
M22x2.5	32	303	42.48	102	93	117	131	140	147	187	411	102
M24x3	36	353	49.35	129	118	148	166	178	186	237	521	129
M27x3	41	459	64.32	189	174	217	243	260	273	347	764	189
M30x3.5	46	561	78.49	257	235	294	330	353	370	471	1,036	257
M33x3.5	50	694	97.10	349	320	401	449	481	503	641	1,410	349
M36x4	55	817	114.35	449	412	515	576	617	646	823	1,811	449
M39x4	60	976	136.61	581	533	666	746	799	836	1,066	2,344	581
M42x4.5	65	1121	156.94	718	659	824	923	989	1,035	1,318	2,900	718
M45x4.5	70	1306	182.85	897	823	1,029	1,152	1,234	1,292	1,646	3,620	897
M48x5	75	1473	206.25	1,079	990	1,238	1,386	1,485	1,554	1,980	4,356	1,079
M52x5	80	1758	246.11	1,395	1,280	1,600	1,792	1,920	2,009	2,560	5,631	1,395
M56x5.5	85	2030	284.22	1,735	1,592	1,990	2,228	2,387	2,499	3,183	7,003	1,735
M60x5.5	90	2362	330.70	2,163	1,984	2,480	2,778	2,976	3,115	3,968	8,730	2,163
M64x6	95	2676	374.65	2,614	2,398	2,997	3,357	3,597	3,765	4,796	10,550	2,614
M68x6	100	3055	427.76	3,171	2,909	3,636	4,072	4,363	4,567	5,818	12,799	3,171
M72x6	105	3460	484.38	3,801	3,488	4,359	4,883	5,231	5,475	6,975	15,345	3,801
M76x6	110	3889	544.53	4,511	4,138	5,173	5,794	6,208	6,497	8,277	18,209	4,511
M80x6	115	4344	608.19	5,303	4,866	6,082	6,812	7,298	7,639	9,731	21,408	5,303
M90x6	130	5591	782.74	7,679	7,045	8,806	9,862	10,567	11,060	14,089	30,996	7,679
M100x6	145	6995	979.28	10,674	9,793	12,241	13,710	14,689	15,375	19,586	43,088	10,674
M110x6	155	8556	1,197.81	14,362	13,176	16,470	18,446	19,764	20,686	26,352	57,974	14,362
M125x6	180	11192	1,566.84	21,348	19,585	24,482	27,420	29,378	30,749	39,171	86,176	21,348

TORQUE GUIDE FOR MATERIAL STANDARD **1.1181**

MINIMUM YIELD (Mpa) 280

BOLT LOAD BASED ON 60 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	41.13	90	82	103	115	123	129	165	362	90
M22x2.5	32	303	50.97	122	112	140	157	168	176	224	493	122
M24x3	36	353	59.22	155	142	178	199	213	223	284	625	155
M27x3	41	459	77.18	227	208	260	292	313	327	417	917	227
M30x3.5	46	561	94.18	308	283	353	396	424	444	565	1,243	308
M33x3.5	50	694	116.52	419	385	481	538	577	604	769	1,692	419
M36x4	55	817	137.22	538	494	617	692	741	776	988	2,174	538
M39x4	60	976	163.93	697	639	799	895	959	1,004	1,279	2,813	697
M42x4.5	65	1121	188.32	862	791	989	1,107	1,186	1,242	1,582	3,480	862
M45x4.5	70	1306	219.42	1,076	987	1,234	1,382	1,481	1,550	1,975	4,344	1,076
M48x5	75	1473	247.50	1,295	1,188	1,485	1,663	1,782	1,865	2,376	5,227	1,295
M52x5	80	1758	295.33	1,674	1,536	1,920	2,150	2,304	2,411	3,071	6,757	1,674
M56x5.5	85	2030	341.06	2,082	1,910	2,387	2,674	2,865	2,999	3,820	8,404	2,082
M60x5.5	90	2362	396.84	2,595	2,381	2,976	3,333	3,572	3,738	4,762	10,476	2,595
M64x6	95	2676	449.58	3,136	2,877	3,597	4,028	4,316	4,517	5,755	12,660	3,136
M68x6	100	3055	513.31	3,805	3,491	4,363	4,887	5,236	5,480	6,981	15,358	3,805
M72x6	105	3460	581.26	4,562	4,185	5,231	5,859	6,278	6,571	8,370	18,414	4,562
M76x6	110	3889	653.43	5,413	4,966	6,208	6,953	7,449	7,797	9,932	21,851	5,413
M80x6	115	4344	729.83	6,364	5,839	7,298	8,174	8,758	9,167	11,677	25,690	6,364
M90x6	130	5591	939.28	9,214	8,454	10,567	11,835	12,680	13,272	16,907	37,196	9,214
M100x6	145	6995	1,175.13	12,809	11,751	14,689	16,452	17,627	18,450	23,503	51,706	12,809
M110x6	155	8556	1,437.37	17,234	15,811	19,764	22,135	23,717	24,823	31,622	69,569	17,234
M125x6	180	11192	1,880.20	25,618	23,503	29,378	32,904	35,254	36,899	47,005	103,411	25,618

TORQUE GUIDE FOR MATERIAL STANDARD **1.1181**

MINIMUM YIELD (Mpa) 280

BOLT LOAD BASED ON 70 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	47.98	105	96	120	134	144	151	192	422	105
M22x2.5	32	303	59.47	143	131	164	183	196	205	262	576	143
M24x3	36	353	69.09	181	166	207	232	249	260	332	730	181
M27x3	41	459	90.05	265	243	304	340	365	382	486	1,070	265
M30x3.5	46	561	109.88	359	330	412	461	494	518	659	1,450	359
M33x3.5	50	694	135.94	489	449	561	628	673	704	897	1,974	489
M36x4	55	817	160.09	628	576	720	807	864	905	1,153	2,536	628
M39x4	60	976	191.26	813	746	932	1,044	1,119	1,171	1,492	3,282	813
M42x4.5	65	1121	219.71	1,006	923	1,153	1,292	1,384	1,449	1,846	4,060	1,006
M45x4.5	70	1306	255.99	1,256	1,152	1,440	1,613	1,728	1,809	2,304	5,069	1,256
M48x5	75	1473	288.75	1,511	1,386	1,733	1,940	2,079	2,176	2,772	6,098	1,511
M52x5	80	1758	344.55	1,953	1,792	2,240	2,508	2,687	2,813	3,583	7,883	1,953
M56x5.5	85	2030	397.90	2,429	2,228	2,785	3,120	3,342	3,498	4,456	9,804	2,429
M60x5.5	90	2362	462.98	3,028	2,778	3,472	3,889	4,167	4,361	5,556	12,223	3,028
M64x6	95	2676	524.51	3,659	3,357	4,196	4,700	5,035	5,270	6,714	14,770	3,659
M68x6	100	3055	598.86	4,439	4,072	5,090	5,701	6,108	6,393	8,145	17,918	4,439
M72x6	105	3460	678.14	5,322	4,883	6,103	6,836	7,324	7,666	9,765	21,483	5,322
M76x6	110	3889	762.34	6,315	5,794	7,242	8,111	8,691	9,096	11,588	25,493	6,315
M80x6	115	4344	851.46	7,425	6,812	8,515	9,536	10,218	10,694	13,623	29,972	7,425
M90x6	130	5591	1,095.83	10,750	9,862	12,328	13,807	14,794	15,484	19,725	43,395	10,750
M100x6	145	6995	1,370.99	14,944	13,710	17,137	19,194	20,565	21,524	27,420	60,323	14,944
M110x6	155	8556	1,676.93	20,106	18,446	23,058	25,825	27,669	28,961	36,892	81,163	20,106
M125x6	180	11192	2,193.57	29,887	27,420	34,275	38,388	41,129	43,049	54,839	120,646	29,887

TORQUE GUIDE FOR MATERIAL STANDARD **1.1181**

MINIMUM YIELD (Mpa) 280

BOLT LOAD BASED ON 80 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	54.84	120	110	137	154	165	172	219	483	120
M22x2.5	32	303	67.96	163	150	187	209	224	235	299	658	163
M24x3	36	353	78.97	207	190	237	265	284	298	379	834	207
M27x3	41	459	102.91	303	278	347	389	417	436	556	1,223	303
M30x3.5	46	561	125.58	411	377	471	527	565	591	753	1,658	411
M33x3.5	50	694	155.36	559	513	641	718	769	805	1,025	2,256	559
M36x4	55	817	182.96	718	659	823	922	988	1,034	1,317	2,898	718
M39x4	60	976	218.58	929	852	1,066	1,193	1,279	1,338	1,705	3,751	929
M42x4.5	65	1121	251.10	1,150	1,055	1,318	1,476	1,582	1,656	2,109	4,640	1,150
M45x4.5	70	1306	292.56	1,435	1,317	1,646	1,843	1,975	2,067	2,633	5,793	1,435
M48x5	75	1473	330.00	1,727	1,584	1,980	2,218	2,376	2,487	3,168	6,970	1,727
M52x5	80	1758	393.77	2,232	2,048	2,560	2,867	3,071	3,215	4,095	9,010	2,232
M56x5.5	85	2030	454.74	2,776	2,547	3,183	3,565	3,820	3,998	5,093	11,205	2,776
M60x5.5	90	2362	529.11	3,460	3,175	3,968	4,445	4,762	4,984	6,349	13,969	3,460
M64x6	95	2676	599.44	4,182	3,836	4,796	5,371	5,755	6,023	7,673	16,880	4,182
M68x6	100	3055	684.41	5,073	4,654	5,818	6,516	6,981	7,307	9,308	20,478	5,073
M72x6	105	3460	775.01	6,082	5,580	6,975	7,812	8,370	8,761	11,160	24,552	6,082
M76x6	110	3889	871.24	7,217	6,621	8,277	9,270	9,932	10,396	13,243	29,134	7,217
M80x6	115	4344	973.10	8,485	7,785	9,731	10,899	11,677	12,222	15,570	34,253	8,485
M90x6	130	5591	1,252.38	12,286	11,271	14,089	15,780	16,907	17,696	22,543	49,594	12,286
M100x6	145	6995	1,566.84	17,079	15,668	19,586	21,936	23,503	24,599	31,337	68,941	17,079
M110x6	155	8556	1,916.49	22,979	21,081	26,352	29,514	31,622	33,098	42,163	92,758	22,979
M125x6	180	11192	2,506.94	34,157	31,337	39,171	43,871	47,005	49,199	62,673	137,882	34,157

TORQUE GUIDE FOR MATERIAL STANDARD **1.1181**

MINIMUM YIELD (Mpa) 280

BOLT LOAD BASED ON 90 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	61.69	134	123	154	173	185	194	247	543	134
M22x2.5	32	303	76.46	183	168	210	235	252	264	336	740	183
M24x3	36	353	88.84	232	213	267	298	320	335	426	938	232
M27x3	41	459	115.78	341	313	391	438	469	491	625	1,375	341
M30x3.5	46	561	141.28	462	424	530	593	636	665	848	1,865	462
M33x3.5	50	694	174.78	629	577	721	808	865	906	1,154	2,538	629
M36x4	55	817	205.82	808	741	926	1,037	1,111	1,163	1,482	3,260	808
M39x4	60	976	245.90	1,045	959	1,199	1,343	1,439	1,506	1,918	4,220	1,045
M42x4.5	65	1121	282.48	1,293	1,186	1,483	1,661	1,780	1,863	2,373	5,220	1,293
M45x4.5	70	1306	329.13	1,614	1,481	1,851	2,074	2,222	2,325	2,962	6,517	1,614
M48x5	75	1473	371.25	1,942	1,782	2,228	2,495	2,673	2,798	3,564	7,841	1,942
M52x5	80	1758	442.99	2,511	2,304	2,879	3,225	3,455	3,617	4,607	10,136	2,511
M56x5.5	85	2030	511.59	3,123	2,865	3,581	4,011	4,297	4,498	5,730	12,606	3,123
M60x5.5	90	2362	595.25	3,893	3,572	4,464	5,000	5,357	5,607	7,143	15,715	3,893
M64x6	95	2676	674.37	4,704	4,316	5,395	6,042	6,474	6,776	8,632	18,990	4,704
M68x6	100	3055	769.96	5,707	5,236	6,545	7,330	7,854	8,220	10,472	23,037	5,707
M72x6	105	3460	871.89	6,843	6,278	7,847	8,789	9,416	9,856	12,555	27,621	6,843
M76x6	110	3889	980.15	8,120	7,449	9,311	10,429	11,174	11,695	14,898	32,776	8,120
M80x6	115	4344	1,094.74	9,546	8,758	10,947	12,261	13,137	13,750	17,516	38,535	9,546
M90x6	130	5591	1,408.93	13,822	12,680	15,850	17,752	19,020	19,908	25,361	55,793	13,822
M100x6	145	6995	1,762.70	19,213	17,627	22,034	24,678	26,440	27,674	35,254	77,559	19,213
M110x6	155	8556	2,156.05	25,851	23,717	29,646	33,203	35,575	37,235	47,433	104,353	25,851
M125x6	180	11192	2,820.31	38,427	35,254	44,067	49,355	52,881	55,349	70,508	155,117	38,427

TORQUE GUIDE FOR MATERIAL STANDARD **1.1181**

MINIMUM YIELD (Mpa) 280

BOLT LOAD BASED ON 99 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	67.86	148	136	170	190	204	213	271	597	148
M22x2.5	32	303	84.11	202	185	231	259	278	291	370	814	202
M24x3	36	353	97.72	256	235	293	328	352	368	469	1,032	256
M27x3	41	459	127.35	375	344	430	481	516	540	688	1,513	375
M30x3.5	46	561	155.40	508	466	583	653	699	732	932	2,051	508
M33x3.5	50	694	192.26	692	634	793	888	952	996	1,269	2,792	692
M36x4	55	817	226.41	888	815	1,019	1,141	1,223	1,280	1,630	3,586	888
M39x4	60	976	270.49	1,150	1,055	1,319	1,477	1,582	1,656	2,110	4,642	1,150
M42x4.5	65	1121	310.73	1,423	1,305	1,631	1,827	1,958	2,049	2,610	5,742	1,423
M45x4.5	70	1306	362.04	1,776	1,629	2,036	2,281	2,444	2,558	3,258	7,168	1,776
M48x5	75	1473	408.38	2,137	1,960	2,450	2,744	2,940	3,078	3,920	8,625	2,137
M52x5	80	1758	487.29	2,762	2,534	3,167	3,547	3,801	3,978	5,068	11,149	2,762
M56x5.5	85	2030	562.75	3,435	3,151	3,939	4,412	4,727	4,948	6,303	13,866	3,435
M60x5.5	90	2362	654.78	4,282	3,929	4,911	5,500	5,893	6,168	7,857	17,286	4,282
M64x6	95	2676	741.81	5,175	4,748	5,934	6,647	7,121	7,454	9,495	20,889	5,175
M68x6	100	3055	846.96	6,278	5,759	7,199	8,063	8,639	9,042	11,519	25,341	6,278
M72x6	105	3460	959.08	7,527	6,905	8,632	9,668	10,358	10,841	13,811	30,384	7,527
M76x6	110	3889	1,078.16	8,931	8,194	10,243	11,472	12,291	12,865	16,388	36,054	8,931
M80x6	115	4344	1,204.21	10,501	9,634	12,042	13,487	14,451	15,125	19,267	42,388	10,501
M90x6	130	5591	1,549.82	15,204	13,948	17,435	19,528	20,923	21,899	27,897	61,373	15,204
M100x6	145	6995	1,938.97	21,135	19,390	24,237	27,146	29,085	30,442	38,779	85,315	21,135
M110x6	155	8556	2,371.66	28,436	26,088	32,610	36,524	39,132	40,959	52,176	114,788	28,436
M125x6	180	11192	3,102.34	42,269	38,779	48,474	54,291	58,169	60,883	77,558	170,629	42,269

BOLT LOAD (METRIC) SOCKET HEAD CAP SCREWS (MATERIAL 1.4541 Mpa=210)

40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**
MINIMUM YIELD (Mpa) 210
BOLT LOAD BASED ON 40 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	20.56	45	41	51	58	62	65	82	181	45
M22x2.5	32	303	25.49	61	56	70	78	84	88	112	247	61
M24x3	36	353	29.61	77	71	89	99	107	112	142	313	77
M27x3	41	459	38.59	114	104	130	146	156	164	208	458	114
M30x3.5	46	561	47.09	154	141	177	198	212	222	283	622	154
M33x3.5	50	694	58.26	210	192	240	269	288	302	385	846	210
M36x4	55	817	68.61	269	247	309	346	370	388	494	1,087	269
M39x4	60	976	81.97	348	320	400	448	480	502	639	1,407	348
M42x4.5	65	1121	94.16	431	395	494	554	593	621	791	1,740	431
M45x4.5	70	1306	109.71	538	494	617	691	741	775	987	2,172	538
M48x5	75	1473	123.75	647	594	743	832	891	933	1,188	2,614	647
M52x5	80	1758	147.66	837	768	960	1,075	1,152	1,206	1,536	3,379	837
M56x5.5	85	2030	170.53	1,041	955	1,194	1,337	1,432	1,499	1,910	4,202	1,041
M60x5.5	90	2362	198.42	1,298	1,191	1,488	1,667	1,786	1,869	2,381	5,238	1,298
M64x6	95	2676	224.79	1,568	1,439	1,798	2,014	2,158	2,259	2,877	6,330	1,568
M68x6	100	3055	256.65	1,902	1,745	2,182	2,443	2,618	2,740	3,491	7,679	1,902
M72x6	105	3460	290.63	2,281	2,093	2,616	2,930	3,139	3,285	4,185	9,207	2,281
M76x6	110	3889	326.72	2,707	2,483	3,104	3,476	3,725	3,898	4,966	10,925	2,707
M80x6	115	4344	364.91	3,182	2,919	3,649	4,087	4,379	4,583	5,839	12,845	3,182
M90x6	130	5591	469.64	4,607	4,227	5,283	5,917	6,340	6,636	8,454	18,598	4,607
M100x6	145	6995	587.57	6,404	5,876	7,345	8,226	8,813	9,225	11,751	25,853	6,404
M110x6	155	8556	718.68	8,617	7,906	9,882	11,068	11,858	12,412	15,811	34,784	8,617
M125x6	180	11192	940.10	12,809	11,751	14,689	16,452	17,627	18,450	23,503	51,706	12,809

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**
MINIMUM YIELD (Mpa) 210
BOLT LOAD BASED ON 50 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	25.70	56	51	64	72	77	81	103	226	56
M22x2.5	32	303	31.86	76	70	88	98	105	110	140	308	76
M24x3	36	353	37.02	97	89	111	124	133	139	178	391	97
M27x3	41	459	48.24	142	130	163	182	195	204	260	573	142
M30x3.5	46	561	58.86	192	177	221	247	265	277	353	777	192
M33x3.5	50	694	72.83	262	240	300	336	360	377	481	1,057	262
M36x4	55	817	85.76	337	309	386	432	463	485	617	1,358	337
M39x4	60	976	102.46	436	400	499	559	599	627	799	1,758	436
M42x4.5	65	1121	117.70	539	494	618	692	742	776	989	2,175	539
M45x4.5	70	1306	137.14	673	617	771	864	926	969	1,234	2,715	673
M48x5	75	1473	154.69	809	743	928	1,040	1,114	1,166	1,485	3,267	809
M52x5	80	1758	184.58	1,046	960	1,200	1,344	1,440	1,507	1,920	4,223	1,046
M56x5.5	85	2030	213.16	1,301	1,194	1,492	1,671	1,791	1,874	2,387	5,252	1,301
M60x5.5	90	2362	248.02	1,622	1,488	1,860	2,083	2,232	2,336	2,976	6,548	1,622
M64x6	95	2676	280.99	1,960	1,798	2,248	2,518	2,697	2,823	3,597	7,913	1,960
M68x6	100	3055	320.82	2,378	2,182	2,727	3,054	3,272	3,425	4,363	9,599	2,378
M72x6	105	3460	363.29	2,851	2,616	3,270	3,662	3,924	4,107	5,231	11,509	2,851
M76x6	110	3889	408.39	3,383	3,104	3,880	4,345	4,656	4,873	6,208	13,657	3,383
M80x6	115	4344	456.14	3,978	3,649	4,561	5,109	5,474	5,729	7,298	16,056	3,978
M90x6	130	5591	587.05	5,759	5,283	6,604	7,397	7,925	8,295	10,567	23,247	5,759
M100x6	145	6995	734.46	8,006	7,345	9,181	10,282	11,017	11,531	14,689	32,316	8,006
M110x6	155	8556	898.36	10,771	9,882	12,352	13,835	14,823	15,515	19,764	43,480	10,771
M125x6	180	11192	1,175.13	16,011	14,689	18,361	20,565	22,034	23,062	29,378	64,632	16,011

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**
MINIMUM YIELD (Mpa) 210
BOLT LOAD BASED ON 60 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	30.85	67	62	77	86	93	97	123	271	67
M22x2.5	32	303	38.23	92	84	105	118	126	132	168	370	92
M24x3	36	353	44.42	116	107	133	149	160	167	213	469	116
M27x3	41	459	57.89	170	156	195	219	234	245	313	688	170
M30x3.5	46	561	70.64	231	212	265	297	318	333	424	932	231
M33x3.5	50	694	87.39	314	288	360	404	433	453	577	1,269	314
M36x4	55	817	102.91	404	370	463	519	556	582	741	1,630	404
M39x4	60	976	122.95	523	480	599	671	719	753	959	2,110	523
M42x4.5	65	1121	141.24	647	593	742	831	890	931	1,186	2,610	647
M45x4.5	70	1306	164.56	807	741	926	1,037	1,111	1,163	1,481	3,258	807
M48x5	75	1473	185.63	971	891	1,114	1,247	1,337	1,399	1,782	3,920	971
M52x5	80	1758	221.50	1,255	1,152	1,440	1,612	1,728	1,808	2,304	5,068	1,255
M56x5.5	85	2030	255.79	1,561	1,432	1,791	2,005	2,149	2,249	2,865	6,303	1,561
M60x5.5	90	2362	297.63	1,946	1,786	2,232	2,500	2,679	2,804	3,572	7,857	1,946
M64x6	95	2676	337.19	2,352	2,158	2,697	3,021	3,237	3,388	4,316	9,495	2,352
M68x6	100	3055	384.98	2,853	2,618	3,272	3,665	3,927	4,110	5,236	11,519	2,853
M72x6	105	3460	435.94	3,421	3,139	3,924	4,394	4,708	4,928	6,278	13,811	3,421
M76x6	110	3889	490.07	4,060	3,725	4,656	5,214	5,587	5,848	7,449	16,388	4,060
M80x6	115	4344	547.37	4,773	4,379	5,474	6,131	6,568	6,875	8,758	19,267	4,773
M90x6	130	5591	704.46	6,911	6,340	7,925	8,876	9,510	9,954	12,680	27,897	6,911
M100x6	145	6995	881.35	9,607	8,813	11,017	12,339	13,220	13,837	17,627	38,779	9,607
M110x6	155	8556	1,078.03	12,926	11,858	14,823	16,602	17,787	18,618	23,717	52,176	12,926
M125x6	180	11192	1,410.15	19,213	17,627	22,034	24,678	26,440	27,674	35,254	77,558	19,213

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**
MINIMUM YIELD (Mpa) 210
BOLT LOAD BASED ON 70 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	35.99	78	72	90	101	108	113	144	317	78
M22x2.5	32	303	44.60	107	98	123	137	147	154	196	432	107
M24x3	36	353	51.82	136	124	155	174	187	195	249	547	136
M27x3	41	459	67.54	199	182	228	255	274	286	365	802	199
M30x3.5	46	561	82.41	269	247	309	346	371	388	494	1,088	269
M33x3.5	50	694	101.96	367	336	421	471	505	528	673	1,480	367
M36x4	55	817	120.06	471	432	540	605	648	679	864	1,902	471
M39x4	60	976	143.44	610	559	699	783	839	878	1,119	2,461	610
M42x4.5	65	1121	164.78	754	692	865	969	1,038	1,087	1,384	3,045	754
M45x4.5	70	1306	191.99	942	864	1,080	1,210	1,296	1,356	1,728	3,801	942
M48x5	75	1473	216.56	1,133	1,040	1,299	1,455	1,559	1,632	2,079	4,574	1,133
M52x5	80	1758	258.41	1,465	1,344	1,680	1,881	2,016	2,110	2,687	5,912	1,465
M56x5.5	85	2030	298.43	1,822	1,671	2,089	2,340	2,507	2,624	3,342	7,353	1,822
M60x5.5	90	2362	347.23	2,271	2,083	2,604	2,917	3,125	3,271	4,167	9,167	2,271
M64x6	95	2676	393.38	2,744	2,518	3,147	3,525	3,776	3,953	5,035	11,078	2,744
M68x6	100	3055	449.15	3,329	3,054	3,818	4,276	4,581	4,795	6,108	13,438	3,329
M72x6	105	3460	508.60	3,992	3,662	4,577	5,127	5,493	5,749	7,324	16,113	3,992
M76x6	110	3889	571.75	4,736	4,345	5,432	6,083	6,518	6,822	8,691	19,119	4,736
M80x6	115	4344	638.60	5,569	5,109	6,386	7,152	7,663	8,021	10,218	22,479	5,569
M90x6	130	5591	821.87	8,063	7,397	9,246	10,356	11,095	11,613	14,794	32,546	8,063
M100x6	145	6995	1,028.24	11,208	10,282	12,853	14,395	15,424	16,143	20,565	45,243	11,208
M110x6	155	8556	1,257.70	15,080	13,835	17,293	19,369	20,752	21,720	27,669	60,873	15,080
M125x6	180	11192	1,645.18	22,416	20,565	25,706	28,791	30,847	32,287	41,129	90,485	22,416

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**

MINIMUM YIELD (Mpa) 210

BOLT LOAD BASED ON 80 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	41.13	90	82	103	115	123	129	165	362	90
M22x2.5	32	303	50.97	122	112	140	157	168	176	224	493	122
M24x3	36	353	59.22	155	142	178	199	213	223	284	625	155
M27x3	41	459	77.18	227	208	260	292	313	327	417	917	227
M30x3.5	46	561	94.18	308	283	353	396	424	444	565	1,243	308
M33x3.5	50	694	116.52	419	385	481	538	577	604	769	1,692	419
M36x4	55	817	137.22	538	494	617	692	741	776	988	2,174	538
M39x4	60	976	163.93	697	639	799	895	959	1,004	1,279	2,813	697
M42x4.5	65	1121	188.32	862	791	989	1,107	1,186	1,242	1,582	3,480	862
M45x4.5	70	1306	219.42	1,076	987	1,234	1,382	1,481	1,550	1,975	4,344	1,076
M48x5	75	1473	247.50	1,295	1,188	1,485	1,663	1,782	1,865	2,376	5,227	1,295
M52x5	80	1758	295.33	1,674	1,536	1,920	2,150	2,304	2,411	3,071	6,757	1,674
M56x5.5	85	2030	341.06	2,082	1,910	2,387	2,674	2,865	2,999	3,820	8,404	2,082
M60x5.5	90	2362	396.84	2,595	2,381	2,976	3,333	3,572	3,738	4,762	10,476	2,595
M64x6	95	2676	449.58	3,136	2,877	3,597	4,028	4,316	4,517	5,755	12,660	3,136
M68x6	100	3055	513.31	3,805	3,491	4,363	4,887	5,236	5,480	6,981	15,358	3,805
M72x6	105	3460	581.26	4,562	4,185	5,231	5,859	6,278	6,571	8,370	18,414	4,562
M76x6	110	3889	653.43	5,413	4,966	6,208	6,953	7,449	7,797	9,932	21,851	5,413
M80x6	115	4344	729.83	6,364	5,839	7,298	8,174	8,758	9,167	11,677	25,690	6,364
M90x6	130	5591	939.28	9,214	8,454	10,567	11,835	12,680	13,272	16,907	37,196	9,214
M100x6	145	6995	1,175.13	12,809	11,751	14,689	16,452	17,627	18,450	23,503	51,706	12,809
M110x6	155	8556	1,437.37	17,234	15,811	19,764	22,135	23,717	24,823	31,622	69,569	17,234
M125x6	180	11192	1,880.20	25,618	23,503	29,378	32,904	35,254	36,899	47,005	103,411	25,618

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**

MINIMUM YIELD (Mpa) 210

BOLT LOAD BASED ON 90 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	46.27	101	93	116	130	139	145	185	407	101
M22x2.5	32	303	57.35	138	126	158	177	189	198	252	555	138
M24x3	36	353	66.63	174	160	200	224	240	251	320	704	174
M27x3	41	459	86.83	256	234	293	328	352	368	469	1,032	256
M30x3.5	46	561	105.96	346	318	397	445	477	499	636	1,399	346
M33x3.5	50	694	131.09	472	433	541	606	649	679	865	1,903	472
M36x4	55	817	154.37	606	556	695	778	834	872	1,111	2,445	606
M39x4	60	976	184.43	784	719	899	1,007	1,079	1,129	1,439	3,165	784
M42x4.5	65	1121	211.86	970	890	1,112	1,246	1,335	1,397	1,780	3,915	970
M45x4.5	70	1306	246.85	1,211	1,111	1,389	1,555	1,666	1,744	2,222	4,888	1,211
M48x5	75	1473	278.44	1,457	1,337	1,671	1,871	2,005	2,098	2,673	5,881	1,457
M52x5	80	1758	332.25	1,883	1,728	2,160	2,419	2,592	2,712	3,455	7,602	1,883
M56x5.5	85	2030	383.69	2,342	2,149	2,686	3,008	3,223	3,373	4,297	9,454	2,342
M60x5.5	90	2362	446.44	2,920	2,679	3,348	3,750	4,018	4,205	5,357	11,786	2,920
M64x6	95	2676	505.78	3,528	3,237	4,046	4,532	4,855	5,082	6,474	14,243	3,528
M68x6	100	3055	577.47	4,280	3,927	4,909	5,498	5,890	6,165	7,854	17,278	4,280
M72x6	105	3460	653.92	5,132	4,708	5,885	6,591	7,062	7,392	9,416	20,716	5,132
M76x6	110	3889	735.11	6,090	5,587	6,984	7,822	8,380	8,771	11,174	24,582	6,090
M80x6	115	4344	821.05	7,160	6,568	8,211	9,196	9,853	10,312	13,137	28,901	7,160
M90x6	130	5591	1,056.69	10,366	9,510	11,888	13,314	14,265	14,931	19,020	41,845	10,366
M100x6	145	6995	1,322.02	14,410	13,220	16,525	18,508	19,830	20,756	26,440	58,169	14,410
M110x6	155	8556	1,617.04	19,388	17,787	22,234	24,902	26,681	27,926	35,575	78,265	19,388
M125x6	180	11192	2,115.23	28,820	26,440	33,050	37,017	39,661	41,511	52,881	116,338	28,820

BOLT LOADS

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**

MINIMUM YIELD (Mpa) 210

BOLT LOAD BASED ON 99 PERCENT YIELD

				REQUIRED TORQUE (N-m)								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	50.90	111	102	127	143	153	160	204	448	111
M22x2.5	32	303	63.08	151	139	173	194	208	218	278	611	151
M24x3	36	353	73.29	192	176	220	246	264	276	352	774	192
M27x3	41	459	95.52	281	258	322	361	387	405	516	1,135	281
M30x3.5	46	561	116.55	381	350	437	490	524	549	699	1,538	381
M33x3.5	50	694	144.20	519	476	595	666	714	747	952	2,094	519
M36x4	55	817	169.81	666	611	764	856	917	960	1,223	2,690	666
M39x4	60	976	202.87	862	791	989	1,108	1,187	1,242	1,582	3,481	862
M42x4.5	65	1121	233.05	1,067	979	1,224	1,370	1,468	1,537	1,958	4,307	1,067
M45x4.5	70	1306	271.53	1,332	1,222	1,527	1,711	1,833	1,918	2,444	5,376	1,332
M48x5	75	1473	306.28	1,602	1,470	1,838	2,058	2,205	2,308	2,940	6,469	1,602
M52x5	80	1758	365.47	2,071	1,900	2,376	2,661	2,851	2,984	3,801	8,362	2,071
M56x5.5	85	2030	422.06	2,576	2,364	2,954	3,309	3,545	3,711	4,727	10,400	2,576
M60x5.5	90	2362	491.08	3,212	2,947	3,683	4,125	4,420	4,626	5,893	12,965	3,212
M64x6	95	2676	556.36	3,881	3,561	4,451	4,985	5,341	5,590	7,121	15,667	3,881
M68x6	100	3055	635.22	4,708	4,320	5,399	6,047	6,479	6,782	8,639	19,006	4,708
M72x6	105	3460	719.31	5,645	5,179	6,474	7,251	7,769	8,131	10,358	22,788	5,645
M76x6	110	3889	808.62	6,699	6,146	7,682	8,604	9,218	9,648	12,291	27,040	6,699
M80x6	115	4344	903.16	7,876	7,225	9,032	10,115	10,838	11,344	14,451	31,791	7,876
M90x6	130	5591	1,162.36	11,403	10,461	13,077	14,646	15,692	16,424	20,923	46,030	11,403
M100x6	145	6995	1,454.23	15,851	14,542	18,178	20,359	21,813	22,831	29,085	63,986	15,851
M110x6	155	8556	1,778.74	21,327	19,566	24,458	27,393	29,349	30,719	39,132	86,091	21,327
M125x6	180	11192	2,326.75	31,702	29,084	36,356	40,718	43,627	45,663	58,169	127,971	31,702

BOLT LOAD (METRIC) SOCKET HEAD CAP SCREWS (MATERIAL 1.4541 Mpa=450)
40% - 99% YIELD

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**
MINIMUM YIELD (Mpa) **450**
BOLT LOAD BASED ON **40** PERCENT YIELD

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	LoaDISC TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	44.07	96	88	110	123	132	138	176	264	96
M22x2.5	32	303	54.61	131	120	150	168	180	189	240	360	131
M24x3	36	353	63.45	166	152	190	213	228	239	305	457	166
M27x3	41	459	82.70	243	223	279	313	335	351	447	670	243
M30x3.5	46	561	100.91	330	303	378	424	454	475	605	908	330
M33x3.5	50	694	124.85	449	412	515	577	618	647	824	1,236	449
M36x4	55	817	147.02	577	529	662	741	794	831	1,059	1,588	577
M39x4	60	976	175.64	747	685	856	959	1,028	1,075	1,370	2,055	747
M42x4.5	65	1121	201.77	924	847	1,059	1,186	1,271	1,330	1,695	2,542	924
M45x4.5	70	1306	235.09	1,153	1,058	1,322	1,481	1,587	1,661	2,116	3,174	1,153
M48x5	75	1473	265.18	1,387	1,273	1,591	1,782	1,909	1,998	2,546	3,819	1,387
M52x5	80	1758	316.42	1,793	1,645	2,057	2,304	2,468	2,583	3,291	4,936	1,793
M56x5.5	85	2030	365.42	2,231	2,046	2,558	2,865	3,070	3,213	4,093	6,139	2,231
M60x5.5	90	2362	425.18	2,781	2,551	3,189	3,572	3,827	4,005	5,102	7,653	2,781
M64x6	95	2676	481.70	3,360	3,083	3,854	4,316	4,624	4,840	6,166	9,249	3,360
M68x6	100	3055	549.97	4,076	3,740	4,675	5,236	5,610	5,872	7,480	11,219	4,076
M72x6	105	3460	622.78	4,888	4,484	5,605	6,278	6,726	7,040	8,968	13,452	4,888
M76x6	110	3889	700.11	5,800	5,321	6,651	7,449	7,981	8,354	10,642	15,962	5,800
M80x6	115	4344	781.96	6,819	6,256	7,820	8,758	9,383	9,821	12,511	18,767	6,819
M90x6	130	5591	1,006.38	9,873	9,057	11,322	12,680	13,586	14,220	18,115	27,172	9,873
M100x6	145	6995	1,259.07	13,724	12,591	15,738	17,627	18,886	19,767	25,181	37,772	13,724
M110x6	155	8556	1,540.04	18,465	16,940	21,176	23,717	25,411	26,596	33,881	50,821	18,465
M125x6	180	11192	2,014.50	27,448	25,181	31,477	35,254	37,772	39,535	50,363	75,544	27,448

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**												
MINIMUM YIELD (Mpa)		**450**				**REQUIRED TORQUE** (N-m)						
BOLT LOAD BASED ON		**50**	PERCENT YIELD									
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	55.08	120	110	138	154	165	173	220	330	120
M22x2.5	32	303	68.27	164	150	188	210	225	236	300	451	164
M24x3	36	353	79.32	207	190	238	267	286	299	381	571	207
M27x3	41	459	103.37	304	279	349	391	419	438	558	837	304
M30x3.5	46	561	126.14	412	378	473	530	568	594	757	1,135	412
M33x3.5	50	694	156.06	561	515	644	721	772	809	1,030	1,545	561
M36x4	55	817	183.77	721	662	827	926	992	1,039	1,323	1,985	721
M39x4	60	976	219.55	933	856	1,070	1,199	1,284	1,344	1,713	2,569	933
M42x4.5	65	1121	252.22	1,155	1,059	1,324	1,483	1,589	1,663	2,119	3,178	1,155
M45x4.5	70	1306	293.86	1,441	1,322	1,653	1,851	1,984	2,076	2,645	3,967	1,441
M48x5	75	1473	331.47	1,734	1,591	1,989	2,228	2,387	2,498	3,182	4,773	1,734
M52x5	80	1758	395.53	2,242	2,057	2,571	2,879	3,085	3,229	4,114	6,170	2,242
M56x5.5	85	2030	456.77	2,788	2,558	3,197	3,581	3,837	4,016	5,116	7,674	2,788
M60x5.5	90	2362	531.48	3,476	3,189	3,986	4,464	4,783	5,007	6,378	9,567	3,476
M64x6	95	2676	602.12	4,200	3,854	4,817	5,395	5,780	6,050	7,707	11,561	4,200
M68x6	100	3055	687.47	5,096	4,675	5,843	6,545	7,012	7,339	9,350	14,024	5,096
M72x6	105	3460	778.47	6,109	5,605	7,006	7,847	8,408	8,800	11,210	16,815	6,109
M76x6	110	3889	875.13	7,250	6,651	8,314	9,311	9,976	10,442	13,302	19,953	7,250
M80x6	115	4344	977.45	8,523	7,820	9,774	10,947	11,729	12,277	15,639	23,459	8,523
M90x6	130	5591	1,257.97	12,341	11,322	14,152	15,850	16,983	17,775	22,643	33,965	12,341
M100x6	145	6995	1,573.84	17,155	15,738	19,673	22,034	23,608	24,709	31,477	47,215	17,155
M110x6	155	8556	1,925.05	23,081	21,176	26,469	29,646	31,763	33,246	42,351	63,527	23,081
M125x6	180	11192	2,518.13	34,310	31,477	39,346	44,067	47,215	49,418	62,953	94,430	34,310

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**												
MINIMUM YIELD (Mpa)		**450**				**REQUIRED TORQUE** (N-m)						
BOLT LOAD BASED ON		**60**	PERCENT YIELD									
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	66.10	144	132	165	185	198	208	264	397	144
M22x2.5	32	303	81.92	196	180	225	252	270	283	360	541	196
M24x3	36	353	95.18	249	228	286	320	343	359	457	685	249
M27x3	41	459	124.05	365	335	419	469	502	526	670	1,005	365
M30x3.5	46	561	151.37	495	454	568	636	681	713	908	1,362	495
M33x3.5	50	694	187.27	674	618	772	865	927	970	1,236	1,854	674
M36x4	55	817	220.53	865	794	992	1,111	1,191	1,246	1,588	2,382	865
M39x4	60	976	263.47	1,120	1,028	1,284	1,439	1,541	1,613	2,055	3,083	1,120
M42x4.5	65	1121	302.66	1,386	1,271	1,589	1,780	1,907	1,996	2,542	3,814	1,386
M45x4.5	70	1306	352.64	1,730	1,587	1,984	2,222	2,380	2,491	3,174	4,761	1,730
M48x5	75	1473	397.77	2,081	1,909	2,387	2,673	2,864	2,998	3,819	5,728	2,081
M52x5	80	1758	474.64	2,690	2,468	3,085	3,455	3,702	3,875	4,936	7,404	2,690
M56x5.5	85	2030	548.13	3,346	3,070	3,837	4,297	4,604	4,819	6,139	9,209	3,346
M60x5.5	90	2362	637.77	4,171	3,827	4,783	5,357	5,740	6,008	7,653	11,480	4,171
M64x6	95	2676	722.54	5,040	4,624	5,780	6,474	6,936	7,260	9,249	13,873	5,040
M68x6	100	3055	824.96	6,115	5,610	7,012	7,854	8,415	8,807	11,219	16,829	6,115
M72x6	105	3460	934.17	7,331	6,726	8,408	9,416	10,089	10,560	13,452	20,178	7,331
M76x6	110	3889	1,050.16	8,700	7,981	9,976	11,174	11,972	12,530	15,962	23,944	8,700
M80x6	115	4344	1,172.93	10,228	9,383	11,729	13,137	14,075	14,732	18,767	28,150	10,228
M90x6	130	5591	1,509.56	14,809	13,586	16,983	19,020	20,379	21,330	27,172	40,758	14,809
M100x6	145	6995	1,888.60	20,586	18,886	23,608	26,440	28,329	29,651	37,772	56,658	20,586
M110x6	155	8556	2,310.06	27,698	25,411	31,763	35,575	38,116	39,895	50,821	76,232	27,698
M125x6	180	11192	3,021.76	41,171	37,772	47,215	52,881	56,658	59,302	75,544	113,316	41,171

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**						REQUIRED TORQUE (N-m)						
MINIMUM YIELD (Mpa)			**450**									
BOLT LOAD BASED ON			**70**	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	77.11	168	154	193	216	231	242	308	463	168
M22x2.5	32	303	95.58	229	210	263	294	315	330	421	631	229
M24x3	36	353	111.05	290	267	333	373	400	418	533	800	290
M27x3	41	459	144.72	426	391	488	547	586	613	781	1,172	426
M30x3.5	46	561	176.59	577	530	662	742	795	832	1,060	1,589	577
M33x3.5	50	694	218.48	786	721	901	1,009	1,081	1,132	1,442	2,163	786
M36x4	55	817	257.28	1,010	926	1,158	1,297	1,389	1,454	1,852	2,779	1,010
M39x4	60	976	307.38	1,307	1,199	1,498	1,678	1,798	1,882	2,398	3,596	1,307
M42x4.5	65	1121	353.10	1,617	1,483	1,854	2,076	2,225	2,328	2,966	4,449	1,617
M45x4.5	70	1306	411.41	2,018	1,851	2,314	2,592	2,777	2,907	3,703	5,554	2,018
M48x5	75	1473	464.06	2,428	2,228	2,784	3,119	3,341	3,497	4,455	6,683	2,428
M52x5	80	1758	553.74	3,139	2,879	3,599	4,031	4,319	4,521	5,759	8,638	3,139
M56x5.5	85	2030	639.48	3,903	3,581	4,476	5,014	5,372	5,622	7,162	10,743	3,903
M60x5.5	90	2362	744.07	4,866	4,464	5,581	6,250	6,697	7,009	8,929	13,393	4,866
M64x6	95	2676	842.97	5,881	5,395	6,744	7,553	8,092	8,470	10,790	16,185	5,881
M68x6	100	3055	962.46	7,134	6,545	8,181	9,163	9,817	10,275	13,089	19,634	7,134
M72x6	105	3460	1,089.86	8,553	7,847	9,809	10,986	11,771	12,320	15,694	23,541	8,553
M76x6	110	3889	1,225.18	10,149	9,311	11,639	13,036	13,967	14,619	18,623	27,934	10,149
M80x6	115	4344	1,368.42	11,933	10,947	13,684	15,326	16,421	17,187	21,895	32,842	11,933
M90x6	130	5591	1,761.16	17,277	15,850	19,813	22,191	23,776	24,885	31,701	47,551	17,277
M100x6	145	6995	2,203.37	24,017	22,034	27,542	30,847	33,051	34,593	44,067	66,101	24,017
M110x6	155	8556	2,695.07	32,314	29,646	37,057	41,504	44,469	46,544	59,291	88,937	32,314
M125x6	180	11192	3,525.38	48,033	44,067	55,084	61,694	66,101	69,186	88,135	132,202	48,033

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**						REQUIRED TORQUE (N-m)						
MINIMUM YIELD (Mpa)			**450**									
BOLT LOAD BASED ON			**80**	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	88.13	192	176	220	247	264	277	353	529	192
M22x2.5	32	303	109.23	262	240	300	336	360	377	481	721	262
M24x3	36	353	126.91	332	305	381	426	457	478	609	914	332
M27x3	41	459	165.39	487	447	558	625	670	701	893	1,340	487
M30x3.5	46	561	201.82	660	605	757	848	908	951	1,211	1,816	660
M33x3.5	50	694	249.69	898	824	1,030	1,154	1,236	1,294	1,648	2,472	898
M36x4	55	817	294.03	1,154	1,059	1,323	1,482	1,588	1,662	2,117	3,176	1,154
M39x4	60	976	351.29	1,493	1,370	1,713	1,918	2,055	2,151	2,740	4,110	1,493
M42x4.5	65	1121	403.55	1,847	1,695	2,119	2,373	2,542	2,661	3,390	5,085	1,847
M45x4.5	70	1306	470.18	2,306	2,116	2,645	2,962	3,174	3,322	4,232	6,347	2,306
M48x5	75	1473	530.36	2,775	2,546	3,182	3,564	3,819	3,997	5,091	7,637	2,775
M52x5	80	1758	632.85	3,587	3,291	4,114	4,607	4,936	5,167	6,582	9,872	3,587
M56x5.5	85	2030	730.84	4,461	4,093	5,116	5,730	6,139	6,426	8,185	12,278	4,461
M60x5.5	90	2362	850.36	5,561	5,102	6,378	7,143	7,653	8,010	10,204	15,307	5,561
M64x6	95	2676	963.39	6,721	6,166	7,707	8,632	9,249	9,680	12,331	18,497	6,721
M68x6	100	3055	1,099.95	8,153	7,480	9,350	10,472	11,219	11,743	14,959	22,439	8,153
M72x6	105	3460	1,245.56	9,775	8,968	11,210	12,555	13,452	14,080	17,936	26,904	9,775
M76x6	110	3889	1,400.21	11,599	10,642	13,302	14,898	15,962	16,707	21,283	31,925	11,599
M80x6	115	4344	1,563.91	13,637	12,511	15,639	17,516	18,767	19,643	25,023	37,534	13,637
M90x6	130	5591	2,012.75	19,745	18,115	22,643	25,361	27,172	28,440	36,230	54,344	19,745
M100x6	145	6995	2,518.14	27,448	25,181	31,477	35,254	37,772	39,535	50,363	75,544	27,448
M110x6	155	8556	3,080.08	36,930	33,881	42,351	47,433	50,821	53,193	67,762	101,643	36,930
M125x6	180	11192	4,029.01	54,895	50,363	62,953	70,508	75,544	79,069	100,725	151,088	54,895

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			**450**									
BOLT LOAD BASED ON			**90**	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	99.15	216	198	248	278	297	311	397	595	216
M22x2.5	32	303	122.88	295	270	338	378	406	424	541	811	295
M24x3	36	353	142.77	373	343	428	480	514	538	685	1,028	373
M27x3	41	459	186.07	548	502	628	703	754	789	1,005	1,507	548
M30x3.5	46	561	227.05	742	681	851	954	1,022	1,069	1,362	2,043	742
M33x3.5	50	694	280.90	1,010	927	1,159	1,298	1,390	1,455	1,854	2,781	1,010
M36x4	55	817	330.79	1,298	1,191	1,489	1,667	1,786	1,870	2,382	3,573	1,298
M39x4	60	976	395.20	1,680	1,541	1,927	2,158	2,312	2,420	3,083	4,624	1,680
M42x4.5	65	1121	453.99	2,078	1,907	2,383	2,669	2,860	2,994	3,814	5,720	2,078
M45x4.5	70	1306	528.96	2,595	2,380	2,975	3,332	3,570	3,737	4,761	7,141	2,595
M48x5	75	1473	596.65	3,122	2,864	3,580	4,010	4,296	4,496	5,728	8,592	3,122
M52x5	80	1758	711.95	4,035	3,702	4,628	5,183	5,553	5,812	7,404	11,106	4,035
M56x5.5	85	2030	822.19	5,019	4,604	5,755	6,446	6,906	7,229	9,209	13,813	5,019
M60x5.5	90	2362	956.66	6,257	5,740	7,175	8,036	8,610	9,012	11,480	17,220	6,257
M64x6	95	2676	1,083.81	7,561	6,936	8,671	9,711	10,405	10,890	13,873	20,809	7,561
M68x6	100	3055	1,237.44	9,172	8,415	10,518	11,780	12,622	13,211	16,829	25,244	9,172
M72x6	105	3460	1,401.25	10,997	10,089	12,611	14,125	15,134	15,840	20,178	30,267	10,997
M76x6	110	3889	1,575.24	13,049	11,972	14,965	16,761	17,958	18,796	23,944	35,915	13,049
M80x6	115	4344	1,759.40	15,342	14,075	17,594	19,705	21,113	22,098	28,150	42,226	15,342
M90x6	130	5591	2,264.35	22,213	20,379	25,474	28,531	30,569	31,995	40,758	61,137	22,213
M100x6	145	6995	2,832.91	30,879	28,329	35,411	39,661	42,494	44,477	56,658	84,987	30,879
M110x6	155	8556	3,465.09	41,546	38,116	47,645	53,362	57,174	59,842	76,232	114,348	41,546
M125x6	180	11192	4,532.64	61,757	56,658	70,822	79,321	84,987	88,953	113,316	169,974	61,757

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			**450**									
BOLT LOAD BASED ON			**99**	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	109.06	238	218	273	305	327	342	436	654	238
M22x2.5	32	303	135.17	324	297	372	416	446	467	595	892	324
M24x3	36	353	157.05	411	377	471	528	565	592	754	1,131	411
M27x3	41	459	204.68	602	553	691	774	829	868	1,105	1,658	602
M30x3.5	46	561	249.75	817	749	937	1,049	1,124	1,176	1,499	2,248	817
M33x3.5	50	694	308.99	1,111	1,020	1,275	1,428	1,530	1,601	2,039	3,059	1,111
M36x4	55	817	363.87	1,428	1,310	1,637	1,834	1,965	2,057	2,620	3,930	1,428
M39x4	60	976	434.72	1,848	1,695	2,119	2,374	2,543	2,662	3,391	5,086	1,848
M42x4.5	65	1121	499.39	2,286	2,097	2,622	2,936	3,146	3,293	4,195	6,292	2,286
M45x4.5	70	1306	581.85	2,854	2,618	3,273	3,666	3,927	4,111	5,237	7,855	2,854
M48x5	75	1473	656.32	3,434	3,150	3,938	4,410	4,725	4,946	6,301	9,451	3,434
M52x5	80	1758	783.15	4,439	4,072	5,090	5,701	6,109	6,394	8,145	12,217	4,439
M56x5.5	85	2030	904.41	5,521	5,065	6,331	7,091	7,597	7,952	10,129	15,194	5,521
M60x5.5	90	2362	1,052.32	6,882	6,314	7,892	8,840	9,471	9,913	12,628	18,942	6,882
M64x6	95	2676	1,192.20	8,317	7,630	9,538	10,682	11,445	11,979	15,260	22,890	8,317
M68x6	100	3055	1,361.19	10,089	9,256	11,570	12,959	13,884	14,532	18,512	27,768	10,089
M72x6	105	3460	1,541.38	12,097	11,098	13,872	15,537	16,647	17,424	22,196	33,294	12,097
M76x6	110	3889	1,732.76	14,354	13,169	16,461	18,437	19,753	20,675	26,338	39,507	14,354
M80x6	115	4344	1,935.34	16,876	15,483	19,353	21,676	23,224	24,308	30,965	46,448	16,876
M90x6	130	5591	2,490.78	24,435	22,417	28,021	31,384	33,626	35,195	44,834	67,251	24,435
M100x6	145	6995	3,116.20	33,967	31,162	38,952	43,627	46,743	48,924	62,324	93,486	33,967
M110x6	155	8556	3,811.59	45,701	41,928	52,409	58,699	62,891	65,826	83,855	125,783	45,701
M125x6	180	11192	4,985.90	67,933	62,324	77,905	87,253	93,486	97,848	124,647	186,971	67,933

BOLT LOAD (METRIC) SOCKET HEAD CAP SCREWS (MATERIAL 1.4541 Mpa=600)
40% - 99% YIELD

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR MATERIAL STANDARD 1.4541						REQUIRED TORQUE (N-m)						
MINIMUM YIELD (Mpa)			600									
BOLT LOAD BASED ON			40	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	58.75	128	118	147	165	176	184	235	353	128
M22x2.5	32	303	72.82	175	160	200	224	240	252	320	481	175
M24x3	36	353	84.61	221	203	254	284	305	319	406	609	221
M27x3	41	459	110.26	325	298	372	417	447	467	595	893	325
M30x3.5	46	561	134.55	440	404	505	565	605	634	807	1,211	440
M33x3.5	50	694	166.46	599	549	687	769	824	862	1,099	1,648	599
M36x4	55	817	196.02	769	706	882	988	1,059	1,108	1,411	2,117	769
M39x4	60	976	234.19	996	913	1,142	1,279	1,370	1,434	1,827	2,740	996
M42x4.5	65	1121	269.03	1,232	1,130	1,412	1,582	1,695	1,774	2,260	3,390	1,232
M45x4.5	70	1306	313.46	1,537	1,411	1,763	1,975	2,116	2,215	2,821	4,232	1,537
M48x5	75	1473	353.57	1,850	1,697	2,121	2,376	2,546	2,665	3,394	5,091	1,850
M52x5	80	1758	421.90	2,391	2,194	2,742	3,071	3,291	3,444	4,388	6,582	2,391
M56x5.5	85	2030	487.23	2,974	2,728	3,411	3,820	4,093	4,284	5,457	8,185	2,974
M60x5.5	90	2362	566.91	3,708	3,401	4,252	4,762	5,102	5,340	6,803	10,204	3,708
M64x6	95	2676	642.26	4,480	4,110	5,138	5,755	6,166	6,453	8,221	12,331	4,480
M68x6	100	3055	733.30	5,435	4,986	6,233	6,981	7,480	7,829	9,973	14,959	5,435
M72x6	105	3460	830.37	6,517	5,979	7,473	8,370	8,968	9,387	11,957	17,936	6,517
M76x6	110	3889	933.47	7,733	7,094	8,868	9,932	10,642	11,138	14,189	21,283	7,733
M80x6	115	4344	1,042.61	9,092	8,341	10,426	11,677	12,511	13,095	16,682	25,023	9,092
M90x6	130	5591	1,341.83	13,163	12,077	15,096	16,907	18,115	18,960	24,153	36,230	13,163
M100x6	145	6995	1,678.76	18,298	16,788	20,984	23,503	25,181	26,357	33,575	50,363	18,298
M110x6	155	8556	2,053.38	24,620	22,587	28,234	31,622	33,881	35,462	45,174	67,762	24,620
M125x6	180	11192	2,686.01	36,597	33,575	41,969	47,005	50,363	52,713	67,150	100,725	36,597

TORQUE GUIDE FOR MATERIAL STANDARD 1.4541						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)		600										
BOLT LOAD BASED ON		50	PERCENT YIELD									
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	73.44	160	147	184	206	220	231	294	441	160
M22x2.5	32	303	91.02	218	200	250	280	300	314	401	601	218
M24x3	36	353	105.76	277	254	317	355	381	398	508	761	277
M27x3	41	459	137.83	406	372	465	521	558	584	744	1,116	406
M30x3.5	46	561	168.19	550	505	631	706	757	792	1,009	1,514	550
M33x3.5	50	694	208.08	748	687	858	961	1,030	1,078	1,373	2,060	748
M36x4	55	817	245.03	961	882	1,103	1,235	1,323	1,385	1,764	2,646	961
M39x4	60	976	292.74	1,244	1,142	1,427	1,598	1,713	1,792	2,283	3,425	1,244
M42x4.5	65	1121	336.29	1,540	1,412	1,766	1,977	2,119	2,217	2,825	4,237	1,540
M45x4.5	70	1306	391.82	1,922	1,763	2,204	2,468	2,645	2,768	3,526	5,290	1,922
M48x5	75	1473	441.97	2,312	2,121	2,652	2,970	3,182	3,331	4,243	6,364	2,312
M52x5	80	1758	527.37	2,989	2,742	3,428	3,839	4,114	4,305	5,485	8,227	2,989
M56x5.5	85	2030	609.03	3,718	3,411	4,263	4,775	5,116	5,355	6,821	10,232	3,718
M60x5.5	90	2362	708.64	4,634	4,252	5,315	5,953	6,378	6,675	8,504	12,755	4,634
M64x6	95	2676	802.83	5,601	5,138	6,423	7,193	7,707	8,067	10,276	15,414	5,601
M68x6	100	3055	916.62	6,794	6,233	7,791	8,726	9,350	9,786	12,466	18,699	6,794
M72x6	105	3460	1,037.96	8,146	7,473	9,342	10,463	11,210	11,733	14,947	22,420	8,146
M76x6	110	3889	1,166.84	9,666	8,868	11,085	12,415	13,302	13,923	17,736	26,604	9,666
M80x6	115	4344	1,303.26	11,364	10,426	13,033	14,597	15,639	16,369	20,852	31,278	11,364
M90x6	130	5591	1,677.29	16,454	15,096	18,870	21,134	22,643	23,700	30,191	45,287	16,454
M100x6	145	6995	2,098.45	22,873	20,984	26,231	29,378	31,477	32,946	41,969	62,953	22,873
M110x6	155	8556	2,566.73	30,775	28,234	35,293	39,528	42,351	44,327	56,468	84,702	30,775
M125x6	180	11192	3,357.51	45,746	41,969	52,461	58,756	62,953	65,891	83,938	125,907	45,746

TORQUE GUIDE FOR MATERIAL STANDARD 1.4541						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)		600										
BOLT LOAD BASED ON		60	PERCENT YIELD									
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	88.13	192	176	220	247	264	277	353	529	192
M22x2.5	32	303	109.23	262	240	300	336	360	377	481	721	262
M24x3	36	353	126.91	332	305	381	426	457	478	609	914	332
M27x3	41	459	165.39	487	447	558	625	670	701	893	1,340	487
M30x3.5	46	561	201.82	660	605	757	848	908	951	1,211	1,816	660
M33x3.5	50	694	249.69	898	824	1,030	1,154	1,236	1,294	1,648	2,472	898
M36x4	55	817	294.03	1,154	1,059	1,323	1,482	1,588	1,662	2,117	3,176	1,154
M39x4	60	976	351.29	1,493	1,370	1,713	1,918	2,055	2,151	2,740	4,110	1,493
M42x4.5	65	1121	403.55	1,847	1,695	2,119	2,373	2,542	2,661	3,390	5,085	1,847
M45x4.5	70	1306	470.18	2,306	2,116	2,645	2,962	3,174	3,322	4,232	6,347	2,306
M48x5	75	1473	530.36	2,775	2,546	3,182	3,564	3,819	3,997	5,091	7,637	2,775
M52x5	80	1758	632.85	3,587	3,291	4,114	4,607	4,936	5,167	6,582	9,872	3,587
M56x5.5	85	2030	730.84	4,461	4,093	5,116	5,730	6,139	6,426	8,185	12,278	4,461
M60x5.5	90	2362	850.36	5,561	5,102	6,378	7,143	7,653	8,010	10,204	15,307	5,561
M64x6	95	2676	963.39	6,721	6,166	7,707	8,632	9,249	9,680	12,331	18,497	6,721
M68x6	100	3055	1,099.95	8,153	7,480	9,350	10,472	11,219	11,743	14,959	22,439	8,153
M72x6	105	3460	1,245.56	9,775	8,968	11,210	12,555	13,452	14,080	17,936	26,904	9,775
M76x6	110	3889	1,400.21	11,599	10,642	13,302	14,898	15,962	16,707	21,283	31,925	11,599
M80x6	115	4344	1,563.91	13,637	12,511	15,639	17,516	18,767	19,643	25,023	37,534	13,637
M90x6	130	5591	2,012.75	19,745	18,115	22,643	25,361	27,172	28,440	36,230	54,344	19,745
M100x6	145	6995	2,518.14	27,448	25,181	31,477	35,254	37,772	39,535	50,363	75,544	27,448
M110x6	155	8556	3,080.08	36,930	33,881	42,351	47,433	50,821	53,193	67,762	101,643	36,930
M125x6	180	11192	4,029.01	54,895	50,363	62,953	70,508	75,544	79,069	100,725	151,088	54,895

TORQUE GUIDE FOR MATERIAL STANDARD 1.4541						REQUIRED TORQUE (N-m)						
MINIMUM YIELD (Mpa)			600									
BOLT LOAD BASED ON			70	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	102.82	224	206	257	288	308	323	411	617	224
M22x2.5	32	303	127.43	306	280	350	392	421	440	561	841	306
M24x3	36	353	148.06	387	355	444	497	533	558	711	1,066	387
M27x3	41	459	192.96	568	521	651	729	781	818	1,042	1,563	568
M30x3.5	46	561	235.46	770	706	883	989	1,060	1,109	1,413	2,119	770
M33x3.5	50	694	291.31	1,048	961	1,202	1,346	1,442	1,509	1,923	2,884	1,048
M36x4	55	817	343.04	1,346	1,235	1,544	1,729	1,852	1,939	2,470	3,705	1,346
M39x4	60	976	409.84	1,742	1,598	1,998	2,238	2,398	2,509	3,197	4,795	1,742
M42x4.5	65	1121	470.81	2,155	1,977	2,472	2,768	2,966	3,104	3,955	5,932	2,155
M45x4.5	70	1306	548.55	2,691	2,468	3,086	3,456	3,703	3,875	4,937	7,405	2,691
M48x5	75	1473	618.75	3,237	2,970	3,713	4,158	4,455	4,663	5,940	8,910	3,237
M52x5	80	1758	738.32	4,185	3,839	4,799	5,375	5,759	6,028	7,679	11,518	4,185
M56x5.5	85	2030	852.65	5,205	4,775	5,969	6,685	7,162	7,496	9,550	14,324	5,205
M60x5.5	90	2362	992.09	6,488	5,953	7,441	8,334	8,929	9,345	11,905	17,858	6,488
M64x6	95	2676	1,123.96	7,841	7,193	8,992	10,071	10,790	11,294	14,387	21,580	7,841
M68x6	100	3055	1,283.27	9,512	8,726	10,908	12,217	13,089	13,700	17,453	26,179	9,512
M72x6	105	3460	1,453.15	11,404	10,463	13,078	14,648	15,694	16,426	20,925	31,388	11,404
M76x6	110	3889	1,633.58	13,533	12,415	15,519	17,381	18,623	19,492	24,830	37,246	13,533
M80x6	115	4344	1,824.56	15,910	14,597	18,246	20,435	21,895	22,917	29,193	43,790	15,910
M90x6	130	5591	2,348.21	23,036	21,134	26,417	29,587	31,701	33,180	42,268	63,402	23,036
M100x6	145	6995	2,937.83	32,022	29,378	36,723	41,130	44,067	46,124	58,757	88,135	32,022
M110x6	155	8556	3,593.42	43,085	39,528	49,410	55,339	59,291	62,058	79,055	118,583	43,085
M125x6	180	11192	4,700.51	64,044	58,756	73,445	82,259	88,135	92,248	117,513	176,269	64,044

TORQUE GUIDE FOR MATERIAL STANDARD 1.4541						REQUIRED TORQUE (N-m)						
MINIMUM YIELD (Mpa)			600									
BOLT LOAD BASED ON			80	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	117.51	256	235	294	329	353	369	470	705	256
M22x2.5	32	303	145.64	349	320	401	449	481	503	641	961	349
M24x3	36	353	169.21	443	406	508	569	609	638	812	1,218	443
M27x3	41	459	220.53	649	595	744	834	893	935	1,191	1,786	649
M30x3.5	46	561	269.10	880	807	1,009	1,130	1,211	1,267	1,615	2,422	880
M33x3.5	50	694	332.92	1,198	1,099	1,373	1,538	1,648	1,725	2,197	3,296	1,198
M36x4	55	817	392.05	1,538	1,411	1,764	1,976	2,117	2,216	2,823	4,234	1,538
M39x4	60	976	468.38	1,991	1,827	2,283	2,557	2,740	2,868	3,653	5,480	1,991
M42x4.5	65	1121	538.06	2,463	2,260	2,825	3,164	3,390	3,548	4,520	6,780	2,463
M45x4.5	70	1306	626.91	3,075	2,821	3,526	3,950	4,232	4,429	5,642	8,463	3,075
M48x5	75	1473	707.15	3,700	3,394	4,243	4,752	5,091	5,329	6,789	10,183	3,700
M52x5	80	1758	843.80	4,783	4,388	5,485	6,143	6,582	6,889	8,775	13,163	4,783
M56x5.5	85	2030	974.45	5,948	5,457	6,821	7,640	8,185	8,567	10,914	16,371	5,948
M60x5.5	90	2362	1,133.82	7,415	6,803	8,504	9,524	10,204	10,681	13,606	20,409	7,415
M64x6	95	2676	1,284.52	8,961	8,221	10,276	11,509	12,331	12,907	16,442	24,663	8,961
M68x6	100	3055	1,466.60	10,870	9,973	12,466	13,962	14,959	15,657	19,946	29,919	10,870
M72x6	105	3460	1,660.74	13,033	11,957	14,947	16,740	17,936	18,773	23,915	35,872	13,033
M76x6	110	3889	1,866.95	15,466	14,189	17,736	19,864	21,283	22,276	28,378	42,566	15,466
M80x6	115	4344	2,085.22	18,183	16,682	20,852	23,354	25,023	26,190	33,363	50,045	18,183
M90x6	130	5591	2,683.67	26,327	24,153	30,191	33,814	36,230	37,920	48,306	72,459	26,327
M100x6	145	6995	3,357.52	36,597	33,575	41,969	47,005	50,363	52,713	67,150	100,726	36,597
M110x6	155	8556	4,106.77	49,240	45,174	56,468	63,244	67,762	70,924	90,349	135,523	49,240
M125x6	180	11192	5,372.01	73,194	67,150	83,938	94,010	100,725	105,426	134,300	201,450	73,194

TORQUE GUIDE FOR MATERIAL STANDARD 1.4541						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			600									
BOLT LOAD BASED ON			90	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	132.20	288	264	330	370	397	415	529	793	288
M22x2.5	32	303	163.84	393	360	451	505	541	566	721	1,081	393
M24x3	36	353	190.36	498	457	571	640	685	717	914	1,371	498
M27x3	41	459	248.09	730	670	837	938	1,005	1,052	1,340	2,010	730
M30x3.5	46	561	302.73	990	908	1,135	1,271	1,362	1,426	1,816	2,725	990
M33x3.5	50	694	374.54	1,347	1,236	1,545	1,730	1,854	1,940	2,472	3,708	1,347
M36x4	55	817	441.05	1,731	1,588	1,985	2,223	2,382	2,493	3,176	4,763	1,731
M39x4	60	976	526.93	2,240	2,055	2,569	2,877	3,083	3,226	4,110	6,165	2,240
M42x4.5	65	1121	605.32	2,771	2,542	3,178	3,559	3,814	3,991	5,085	7,627	2,771
M45x4.5	70	1306	705.27	3,459	3,174	3,967	4,443	4,761	4,983	6,347	9,521	3,459
M48x5	75	1473	795.54	4,162	3,819	4,773	5,346	5,728	5,995	7,637	11,456	4,162
M52x5	80	1758	949.27	5,380	4,936	6,170	6,911	7,404	7,750	9,872	14,809	5,380
M56x5.5	85	2030	1,096.26	6,692	6,139	7,674	8,595	9,209	9,638	12,278	18,417	6,692
M60x5.5	90	2362	1,275.54	8,342	7,653	9,567	10,715	11,480	12,016	15,307	22,960	8,342
M64x6	95	2676	1,445.09	10,081	9,249	11,561	12,948	13,873	14,520	18,497	27,746	10,081
M68x6	100	3055	1,649.92	12,229	11,219	14,024	15,707	16,829	17,615	22,439	33,658	12,229
M72x6	105	3460	1,868.33	14,663	13,452	16,815	18,833	20,178	21,120	26,904	40,356	14,663
M76x6	110	3889	2,100.32	17,399	15,962	19,953	22,347	23,944	25,061	31,925	47,887	17,399
M80x6	115	4344	2,345.87	20,456	18,767	23,459	26,274	28,150	29,464	37,534	56,301	20,456
M90x6	130	5591	3,019.13	29,618	27,172	33,965	38,041	40,758	42,660	54,344	81,516	29,618
M100x6	145	6995	3,777.21	41,172	37,772	47,215	52,881	56,658	59,302	75,544	113,316	41,172
M110x6	155	8556	4,620.11	55,395	50,821	63,527	71,150	76,232	79,789	101,643	152,464	55,395
M125x6	180	11192	6,043.51	82,343	75,544	94,430	105,762	113,316	118,604	151,088	226,632	82,343

TORQUE GUIDE FOR MATERIAL STANDARD 1.4541						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			600									
BOLT LOAD BASED ON			99	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	145.42	317	291	364	407	436	457	582	872	317
M22x2.5	32	303	180.23	432	397	496	555	595	623	793	1,190	432
M24x3	36	353	209.40	548	503	628	704	754	789	1,005	1,508	548
M27x3	41	459	272.90	803	737	921	1,032	1,105	1,157	1,474	2,210	803
M30x3.5	46	561	333.01	1,089	999	1,249	1,399	1,499	1,568	1,998	2,997	1,089
M33x3.5	50	694	411.99	1,482	1,360	1,699	1,903	2,039	2,135	2,719	4,079	1,482
M36x4	55	817	485.16	1,904	1,747	2,183	2,445	2,620	2,742	3,493	5,240	1,904
M39x4	60	976	579.62	2,464	2,261	2,826	3,165	3,391	3,549	4,521	6,782	2,464
M42x4.5	65	1121	665.85	3,048	2,797	3,496	3,915	4,195	4,391	5,593	8,390	3,048
M45x4.5	70	1306	775.80	3,805	3,491	4,364	4,888	5,237	5,481	6,982	10,473	3,805
M48x5	75	1473	875.09	4,578	4,200	5,251	5,881	6,301	6,595	8,401	12,601	4,578
M52x5	80	1758	1,044.20	5,919	5,430	6,787	7,602	8,145	8,525	10,860	16,290	5,919
M56x5.5	85	2030	1,205.88	7,361	6,753	8,441	9,454	10,129	10,602	13,506	20,259	7,361
M60x5.5	90	2362	1,403.10	9,176	8,419	10,523	11,786	12,628	13,217	16,837	25,256	9,176
M64x6	95	2676	1,589.60	11,089	10,173	12,717	14,243	15,260	15,972	20,347	30,520	11,089
M68x6	100	3055	1,814.92	13,452	12,341	15,427	17,278	18,512	19,376	24,683	37,024	13,452
M72x6	105	3460	2,055.17	16,129	14,797	18,497	20,716	22,196	23,232	29,594	44,392	16,129
M76x6	110	3889	2,310.35	19,139	17,559	21,948	24,582	26,338	27,567	35,117	52,676	19,139
M80x6	115	4344	2,580.45	22,502	20,644	25,805	28,901	30,965	32,411	41,287	61,931	22,502
M90x6	130	5591	3,321.04	32,579	29,889	37,362	41,845	44,834	46,926	59,779	89,668	32,579
M100x6	145	6995	4,154.93	45,289	41,549	51,937	58,169	62,324	65,232	83,099	124,648	45,289
M110x6	155	8556	5,082.13	60,935	55,903	69,879	78,265	83,855	87,768	111,807	167,710	60,935
M125x6	180	11192	6,647.87	90,577	83,098	103,873	116,338	124,647	130,464	166,197	249,295	90,577

BOLT LOAD (METRIC) SOCKET HEAD CAP SCREWS (MATERIAL 1.4541)

40% - 99% YIELD

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**
MINIMUM YIELD (Mpa) 210
BOLT LOAD BASED ON 40 PERCENT YIELD

BOLT LOADS

				REQUIRED TORQUE (N-m)								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	20.56	45	41	51	58	62	65	82	181	45
M22x2.5	32	303	25.49	61	56	70	78	84	88	112	247	61
M24x3	36	353	29.61	77	71	89	99	107	112	142	313	77
M27x3	41	459	38.59	114	104	130	146	156	164	208	458	114
M30x3.5	46	561	47.09	154	141	177	198	212	222	283	622	154
M33x3.5	50	694	58.26	210	192	240	269	288	302	385	846	210
M36x4	55	817	68.61	269	247	309	346	370	388	494	1,087	269
M39x4	60	976	81.97	348	320	400	448	480	502	639	1,407	348
M42x4.5	65	1121	94.16	431	395	494	554	593	621	791	1,740	431
M45x4.5	70	1306	109.71	538	494	617	691	741	775	987	2,172	538
M48x5	75	1473	123.75	647	594	743	832	891	933	1,188	2,614	647
M52x5	80	1758	147.66	837	768	960	1,075	1,152	1,206	1,536	3,379	837
M56x5.5	85	2030	170.53	1,041	955	1,194	1,337	1,432	1,499	1,910	4,202	1,041
M60x5.5	90	2362	198.42	1,298	1,191	1,488	1,667	1,786	1,869	2,381	5,238	1,298
M64x6	95	2676	224.79	1,568	1,439	1,798	2,014	2,158	2,259	2,877	6,330	1,568
M68x6	100	3055	256.65	1,902	1,745	2,182	2,443	2,618	2,740	3,491	7,679	1,902
M72x6	105	3460	290.63	2,281	2,093	2,616	2,930	3,139	3,285	4,185	9,207	2,281
M76x6	110	3889	326.72	2,707	2,483	3,104	3,476	3,725	3,898	4,966	10,925	2,707
M80x6	115	4344	364.91	3,182	2,919	3,649	4,087	4,379	4,583	5,839	12,845	3,182
M90x6	130	5591	469.64	4,607	4,227	5,283	5,917	6,340	6,636	8,454	18,598	4,607
M100x6	145	6995	587.57	6,404	5,876	7,345	8,226	8,813	9,225	11,751	25,853	6,404
M110x6	155	8556	718.68	8,617	7,906	9,882	11,068	11,858	12,412	15,811	34,784	8,617
M125x6	180	11192	940.10	12,809	11,751	14,689	16,452	17,627	18,450	23,503	51,706	12,809

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**
MINIMUM YIELD (Mpa) 210
BOLT LOAD BASED ON 50 PERCENT YIELD

BOLT LOADS

				REQUIRED TORQUE (N-m)								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	25.70	56	51	64	72	77	81	103	226	56
M22x2.5	32	303	31.86	76	70	88	98	105	110	140	308	76
M24x3	36	353	37.02	97	89	111	124	133	139	178	391	97
M27x3	41	459	48.24	142	130	163	182	195	204	260	573	142
M30x3.5	46	561	58.86	192	177	221	247	265	277	353	777	192
M33x3.5	50	694	72.83	262	240	300	336	360	377	481	1,057	262
M36x4	55	817	85.76	337	309	386	432	463	485	617	1,358	337
M39x4	60	976	102.46	436	400	499	559	599	627	799	1,758	436
M42x4.5	65	1121	117.70	539	494	618	692	742	776	989	2,175	539
M45x4.5	70	1306	137.14	673	617	771	864	926	969	1,234	2,715	673
M48x5	75	1473	154.69	809	743	928	1,040	1,114	1,166	1,485	3,267	809
M52x5	80	1758	184.58	1,046	960	1,200	1,344	1,440	1,507	1,920	4,223	1,046
M56x5.5	85	2030	213.16	1,301	1,194	1,492	1,671	1,791	1,874	2,387	5,252	1,301
M60x5.5	90	2362	248.02	1,622	1,488	1,860	2,083	2,232	2,336	2,976	6,548	1,622
M64x6	95	2676	280.99	1,960	1,798	2,248	2,518	2,697	2,823	3,597	7,913	1,960
M68x6	100	3055	320.82	2,378	2,182	2,727	3,054	3,272	3,425	4,363	9,599	2,378
M72x6	105	3460	363.29	2,851	2,616	3,270	3,662	3,924	4,107	5,231	11,509	2,851
M76x6	110	3889	408.39	3,383	3,104	3,880	4,345	4,656	4,873	6,208	13,657	3,383
M80x6	115	4344	456.14	3,978	3,649	4,561	5,109	5,474	5,729	7,298	16,056	3,978
M90x6	130	5591	587.05	5,759	5,283	6,604	7,397	7,925	8,295	10,567	23,247	5,759
M100x6	145	6995	734.46	8,006	7,345	9,181	10,282	11,017	11,531	14,689	32,316	8,006
M110x6	155	8556	898.36	10,771	9,882	12,352	13,835	14,823	15,515	19,764	43,480	10,771
M125x6	180	11192	1,175.13	16,011	14,689	18,361	20,565	22,034	23,062	29,378	64,632	16,011

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**

MINIMUM YIELD (Mpa) 210

BOLT LOAD BASED ON 60 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	30.85	67	62	77	86	93	97	123	271	67
M22x2.5	32	303	38.23	92	84	105	118	126	132	168	370	92
M24x3	36	353	44.42	116	107	133	149	160	167	213	469	116
M27x3	41	459	57.89	170	156	195	219	234	245	313	688	170
M30x3.5	46	561	70.64	231	212	265	297	318	333	424	932	231
M33x3.5	50	694	87.39	314	288	360	404	433	453	577	1,269	314
M36x4	55	817	102.91	404	370	463	519	556	582	741	1,630	404
M39x4	60	976	122.95	523	480	599	671	719	753	959	2,110	523
M42x4.5	65	1121	141.24	647	593	742	831	890	931	1,186	2,610	647
M45x4.5	70	1306	164.56	807	741	926	1,037	1,111	1,163	1,481	3,258	807
M48x5	75	1473	185.63	971	891	1,114	1,247	1,337	1,399	1,782	3,920	971
M52x5	80	1758	221.50	1,255	1,152	1,440	1,612	1,728	1,808	2,304	5,068	1,255
M56x5.5	85	2030	255.79	1,561	1,432	1,791	2,005	2,149	2,249	2,865	6,303	1,561
M60x5.5	90	2362	297.63	1,946	1,786	2,232	2,500	2,679	2,804	3,572	7,857	1,946
M64x6	95	2676	337.19	2,352	2,158	2,697	3,021	3,237	3,388	4,316	9,495	2,352
M68x6	100	3055	384.98	2,853	2,618	3,272	3,665	3,927	4,110	5,236	11,519	2,853
M72x6	105	3460	435.94	3,421	3,139	3,924	4,394	4,708	4,928	6,278	13,811	3,421
M76x6	110	3889	490.07	4,060	3,725	4,656	5,214	5,587	5,848	7,449	16,388	4,060
M80x6	115	4344	547.37	4,773	4,379	5,474	6,131	6,568	6,875	8,758	19,267	4,773
M90x6	130	5591	704.46	6,911	6,340	7,925	8,876	9,510	9,954	12,680	27,897	6,911
M100x6	145	6995	881.35	9,607	8,813	11,017	12,339	13,220	13,837	17,627	38,779	9,607
M110x6	155	8556	1,078.03	12,926	11,858	14,823	16,602	17,787	18,618	23,717	52,176	12,926
M125x6	180	11192	1,410.15	19,213	17,627	22,034	24,678	26,440	27,674	35,254	77,558	19,213

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**

MINIMUM YIELD (Mpa) 210

BOLT LOAD BASED ON 70 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	35.99	78	72	90	101	108	113	144	317	78
M22x2.5	32	303	44.60	107	98	123	137	147	154	196	432	107
M24x3	36	353	51.82	136	124	155	174	187	195	249	547	136
M27x3	41	459	67.54	199	182	228	255	274	286	365	802	199
M30x3.5	46	561	82.41	269	247	309	346	371	388	494	1,088	269
M33x3.5	50	694	101.96	367	336	421	471	505	528	673	1,480	367
M36x4	55	817	120.06	471	432	540	605	648	679	864	1,902	471
M39x4	60	976	143.44	610	559	699	783	839	878	1,119	2,461	610
M42x4.5	65	1121	164.78	754	692	865	969	1,038	1,087	1,384	3,045	754
M45x4.5	70	1306	191.99	942	864	1,080	1,210	1,296	1,356	1,728	3,801	942
M48x5	75	1473	216.56	1,133	1,040	1,299	1,455	1,559	1,632	2,079	4,574	1,133
M52x5	80	1758	258.41	1,465	1,344	1,680	1,881	2,016	2,110	2,687	5,912	1,465
M56x5.5	85	2030	298.43	1,822	1,671	2,089	2,340	2,507	2,624	3,342	7,353	1,822
M60x5.5	90	2362	347.23	2,271	2,083	2,604	2,917	3,125	3,271	4,167	9,167	2,271
M64x6	95	2676	393.38	2,744	2,518	3,147	3,525	3,776	3,953	5,035	11,078	2,744
M68x6	100	3055	449.15	3,329	3,054	3,818	4,276	4,581	4,795	6,108	13,438	3,329
M72x6	105	3460	508.60	3,992	3,662	4,577	5,127	5,493	5,749	7,324	16,113	3,992
M76x6	110	3889	571.75	4,736	4,345	5,432	6,083	6,518	6,822	8,691	19,119	4,736
M80x6	115	4344	638.60	5,569	5,109	6,386	7,152	7,663	8,021	10,218	22,479	5,569
M90x6	130	5591	821.87	8,063	7,397	9,246	10,356	11,095	11,613	14,794	32,546	8,063
M100x6	145	6995	1,028.24	11,208	10,282	12,853	14,395	15,424	16,143	20,565	45,243	11,208
M110x6	155	8556	1,257.70	15,080	13,835	17,293	19,369	20,752	21,720	27,669	60,873	15,080
M125x6	180	11192	1,645.18	22,416	20,565	25,706	28,791	30,847	32,287	41,129	90,485	22,416

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**

MINIMUM YIELD (Mpa) 210

BOLT LOAD BASED ON 80 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	LoaDISC TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	41.13	90	82	103	115	123	129	165	362	90
M22x2.5	32	303	50.97	122	112	140	157	168	176	224	493	122
M24x3	36	353	59.22	155	142	178	199	213	223	284	625	155
M27x3	41	459	77.18	227	208	260	292	313	327	417	917	227
M30x3.5	46	561	94.18	308	283	353	396	424	444	565	1,243	308
M33x3.5	50	694	116.52	419	385	481	538	577	604	769	1,692	419
M36x4	55	817	137.22	538	494	617	692	741	776	988	2,174	538
M39x4	60	976	163.93	697	639	799	895	959	1,004	1,279	2,813	697
M42x4.5	65	1121	188.32	862	791	989	1,107	1,186	1,242	1,582	3,480	862
M45x4.5	70	1306	219.42	1,076	987	1,234	1,382	1,481	1,550	1,975	4,344	1,076
M48x5	75	1473	247.50	1,295	1,188	1,485	1,663	1,782	1,865	2,376	5,227	1,295
M52x5	80	1758	295.33	1,674	1,536	1,920	2,150	2,304	2,411	3,071	6,757	1,674
M56x5.5	85	2030	341.06	2,082	1,910	2,387	2,674	2,865	2,999	3,820	8,404	2,082
M60x5.5	90	2362	396.84	2,595	2,381	2,976	3,333	3,572	3,738	4,762	10,476	2,595
M64x6	95	2676	449.58	3,136	2,877	3,597	4,028	4,316	4,517	5,755	12,660	3,136
M68x6	100	3055	513.31	3,805	3,491	4,363	4,887	5,236	5,480	6,981	15,358	3,805
M72x6	105	3460	581.26	4,562	4,185	5,231	5,859	6,278	6,571	8,370	18,414	4,562
M76x6	110	3889	653.43	5,413	4,966	6,208	6,953	7,449	7,797	9,932	21,851	5,413
M80x6	115	4344	729.83	6,364	5,839	7,298	8,174	8,758	9,167	11,677	25,690	6,364
M90x6	130	5591	939.28	9,214	8,454	10,567	11,835	12,680	13,272	16,907	37,196	9,214
M100x6	145	6995	1,175.13	12,809	11,751	14,689	16,452	17,627	18,450	23,503	51,706	12,809
M110x6	155	8556	1,437.37	17,234	15,811	19,764	22,135	23,717	24,823	31,622	69,569	17,234
M125x6	180	11192	1,880.20	25,618	23,503	29,378	32,904	35,254	36,899	47,005	103,411	25,618

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**

MINIMUM YIELD (Mpa) 210

BOLT LOAD BASED ON 90 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	LoaDISC TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	46.27	101	93	116	130	139	145	185	407	101
M22x2.5	32	303	57.35	138	126	158	177	189	198	252	555	138
M24x3	36	353	66.63	174	160	200	224	240	251	320	704	174
M27x3	41	459	86.83	256	234	293	328	352	368	469	1,032	256
M30x3.5	46	561	105.96	346	318	397	445	477	499	636	1,399	346
M33x3.5	50	694	131.09	472	433	541	606	649	679	865	1,903	472
M36x4	55	817	154.37	606	556	695	778	834	872	1,111	2,445	606
M39x4	60	976	184.43	784	719	899	1,007	1,079	1,129	1,439	3,165	784
M42x4.5	65	1121	211.86	970	890	1,112	1,246	1,335	1,397	1,780	3,915	970
M45x4.5	70	1306	246.85	1,211	1,111	1,389	1,555	1,666	1,744	2,222	4,888	1,211
M48x5	75	1473	278.44	1,457	1,337	1,671	1,871	2,005	2,098	2,673	5,881	1,457
M52x5	80	1758	332.25	1,883	1,728	2,160	2,419	2,592	2,712	3,455	7,602	1,883
M56x5.5	85	2030	383.69	2,342	2,149	2,686	3,008	3,223	3,373	4,297	9,454	2,342
M60x5.5	90	2362	446.44	2,920	2,679	3,348	3,750	4,018	4,205	5,357	11,786	2,920
M64x6	95	2676	505.78	3,528	3,237	4,046	4,532	4,855	5,082	6,474	14,243	3,528
M68x6	100	3055	577.47	4,280	3,927	4,909	5,498	5,890	6,165	7,854	17,278	4,280
M72x6	105	3460	653.92	5,132	4,708	5,885	6,591	7,062	7,392	9,416	20,716	5,132
M76x6	110	3889	735.11	6,090	5,587	6,984	7,822	8,380	8,771	11,174	24,582	6,090
M80x6	115	4344	821.05	7,160	6,568	8,211	9,196	9,853	10,312	13,137	28,901	7,160
M90x6	130	5591	1,056.69	10,366	9,510	11,888	13,314	14,265	14,931	19,020	41,845	10,366
M100x6	145	6995	1,322.02	14,410	13,220	16,525	18,508	19,830	20,756	26,440	58,169	14,410
M110x6	155	8556	1,617.04	19,388	17,787	22,234	24,902	26,681	27,926	35,575	78,265	19,388
M125x6	180	11192	2,115.23	28,820	26,440	33,050	37,017	39,661	41,511	52,881	116,338	28,820

TORQUE GUIDE FOR MATERIAL STANDARD **1.4541**

MINIMUM YIELD (Mpa) 210

BOLT LOAD BASED ON 99 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	50.90	111	102	127	143	153	160	204	448	111
M22x2.5	32	303	63.08	151	139	173	194	208	218	278	611	151
M24x3	36	353	73.29	192	176	220	246	264	276	352	774	192
M27x3	41	459	95.52	281	258	322	361	387	405	516	1,135	281
M30x3.5	46	561	116.55	381	350	437	490	524	549	699	1,538	381
M33x3.5	50	694	144.20	519	476	595	666	714	747	952	2,094	519
M36x4	55	817	169.81	666	611	764	856	917	960	1,223	2,690	666
M39x4	60	976	202.87	862	791	989	1,108	1,187	1,242	1,582	3,481	862
M42x4.5	65	1121	233.05	1,067	979	1,224	1,370	1,468	1,537	1,958	4,307	1,067
M45x4.5	70	1306	271.53	1,332	1,222	1,527	1,711	1,833	1,918	2,444	5,376	1,332
M48x5	75	1473	306.28	1,602	1,470	1,838	2,058	2,205	2,308	2,940	6,469	1,602
M52x5	80	1758	365.47	2,071	1,900	2,376	2,661	2,851	2,984	3,801	8,362	2,071
M56x5.5	85	2030	422.06	2,576	2,364	2,954	3,309	3,545	3,711	4,727	10,400	2,576
M60x5.5	90	2362	491.08	3,212	2,947	3,683	4,125	4,420	4,626	5,893	12,965	3,212
M64x6	95	2676	556.36	3,881	3,561	4,451	4,985	5,341	5,590	7,121	15,667	3,881
M68x6	100	3055	635.22	4,708	4,320	5,399	6,047	6,479	6,782	8,639	19,006	4,708
M72x6	105	3460	719.31	5,645	5,179	6,474	7,251	7,769	8,131	10,358	22,788	5,645
M76x6	110	3889	808.62	6,699	6,146	7,682	8,604	9,218	9,648	12,291	27,040	6,699
M80x6	115	4344	903.16	7,876	7,225	9,032	10,115	10,838	11,344	14,451	31,791	7,876
M90x6	130	5591	1,162.36	11,403	10,461	13,077	14,646	15,692	16,424	20,923	46,030	11,403
M100x6	145	6995	1,454.23	15,851	14,542	18,178	20,359	21,813	22,831	29,085	63,986	15,851
M110x6	155	8556	1,778.74	21,327	19,566	24,458	27,393	29,349	30,719	39,132	86,091	21,327
M125x6	180	11192	2,326.75	31,702	29,084	36,356	40,718	43,627	45,663	58,169	127,971	31,702

BOLT LOAD (METRIC) (MATERIAL STANDARD 1.4913)

40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR MATERIAL STANDARD 1.4913

MINIMUM YIELD (Mpa): 780

BOLT LOAD BASED ON: 40 PERCENT YIELD

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	76.38	167	153	191	214	229	240	306	458	167
M22x2.5	32	303	94.67	227	208	260	292	312	327	417	625	227
M24x3	36	353	109.99	288	264	330	370	396	414	528	792	288
M27x3	41	459	143.34	422	387	484	542	581	608	774	1,161	422
M30x3.5	46	561	174.91	572	525	656	735	787	824	1,049	1,574	572
M33x3.5	50	694	216.40	778	714	893	1,000	1,071	1,121	1,428	2,142	778
M36x4	55	817	254.83	1,000	917	1,147	1,284	1,376	1,440	1,835	2,752	1,000
M39x4	60	976	304.45	1,294	1,187	1,484	1,662	1,781	1,864	2,375	3,562	1,294
M42x4.5	65	1121	349.74	1,601	1,469	1,836	2,056	2,203	2,306	2,938	4,407	1,601
M45x4.5	70	1306	407.49	1,999	1,834	2,292	2,567	2,751	2,879	3,667	5,501	1,999
M48x5	75	1473	459.64	2,405	2,206	2,758	3,089	3,309	3,464	4,413	6,619	2,405
M52x5	80	1758	548.47	3,109	2,852	3,565	3,993	4,278	4,478	5,704	8,556	3,109
M56x5.5	85	2030	633.39	3,866	3,547	4,434	4,966	5,321	5,569	7,094	10,641	3,866
M60x5.5	90	2362	736.98	4,820	4,422	5,527	6,191	6,633	6,942	8,844	13,266	4,820
M64x6	95	2676	834.94	5,825	5,344	6,680	7,481	8,015	8,389	10,687	16,031	5,825
M68x6	100	3055	953.29	7,066	6,482	8,103	9,075	9,724	10,177	12,965	19,447	7,066
M72x6	105	3460	1,079.48	8,472	7,772	9,715	10,881	11,658	12,202	15,545	23,317	8,472
M76x6	110	3889	1,213.52	10,053	9,223	11,528	12,912	13,834	14,480	18,445	27,668	10,053
M80x6	115	4344	1,355.39	11,819	10,843	13,554	15,180	16,265	17,024	21,686	32,529	11,819
M90x6	130	5591	1,744.38	17,112	15,699	19,624	21,979	23,549	24,648	31,399	47,098	17,112
M100x6	145	6995	2,182.39	23,788	21,824	27,280	30,553	32,736	34,263	43,648	65,472	23,788
M110x6	155	8556	2,669.40	32,006	29,363	36,704	41,109	44,045	46,101	58,727	88,090	32,006
M125x6	180	11192	3,491.81	47,576	43,648	54,560	61,107	65,471	68,527	87,295	130,943	47,576

TORQUE GUIDE FOR MATERIAL STANDARD 1.4913						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			780									
BOLT LOAD BASED ON			50	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	95.48	208	191	239	267	286	300	382	573	208
M22x2.5	32	303	118.33	284	260	325	364	390	409	521	781	284
M24x3	36	353	137.48	360	330	412	462	495	518	660	990	360
M27x3	41	459	179.18	527	484	605	677	726	760	968	1,451	527
M30x3.5	46	561	218.64	715	656	820	918	984	1,030	1,312	1,968	715
M33x3.5	50	694	270.50	973	893	1,116	1,250	1,339	1,401	1,785	2,678	973
M36x4	55	817	318.54	1,250	1,147	1,433	1,605	1,720	1,800	2,293	3,440	1,250
M39x4	60	976	380.56	1,618	1,484	1,855	2,078	2,226	2,330	2,968	4,453	1,618
M42x4.5	65	1121	437.18	2,001	1,836	2,295	2,571	2,754	2,883	3,672	5,508	2,001
M45x4.5	70	1306	509.36	2,498	2,292	2,865	3,209	3,438	3,599	4,584	6,876	2,498
M48x5	75	1473	574.56	3,006	2,758	3,447	3,861	4,137	4,330	5,516	8,274	3,006
M52x5	80	1758	685.59	3,886	3,565	4,456	4,991	5,348	5,597	7,130	10,695	3,886
M56x5.5	85	2030	791.74	4,833	4,434	5,542	6,207	6,651	6,961	8,868	13,301	4,833
M60x5.5	90	2362	921.23	6,025	5,527	6,909	7,738	8,291	8,678	11,055	16,582	6,025
M64x6	95	2676	1,043.67	7,281	6,680	8,349	9,351	10,019	10,487	13,359	20,039	7,281
M68x6	100	3055	1,191.61	8,832	8,103	10,129	11,344	12,154	12,722	16,206	24,309	8,832
M72x6	105	3460	1,349.35	10,590	9,715	12,144	13,601	14,573	15,253	19,431	29,146	10,590
M76x6	110	3889	1,516.89	12,566	11,528	14,410	16,140	17,293	18,100	23,057	34,585	12,566
M80x6	115	4344	1,694.24	14,774	13,554	16,942	18,975	20,331	21,280	27,108	40,662	14,774
M90x6	130	5591	2,180.48	21,391	19,624	24,530	27,474	29,436	30,810	39,249	58,873	21,391
M100x6	145	6995	2,727.98	29,735	27,280	34,100	38,192	40,920	42,829	54,560	81,840	29,735
M110x6	155	8556	3,336.75	40,008	36,704	45,880	51,386	55,056	57,626	73,408	110,113	40,008
M125x6	180	11192	4,364.76	59,470	54,560	68,199	76,383	81,839	85,658	109,119	163,679	59,470

TORQUE GUIDE FOR MATERIAL STANDARD 1.4913						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			780									
BOLT LOAD BASED ON			60	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	114.57	250	229	286	321	344	360	458	687	250
M22x2.5	32	303	142.00	341	312	390	437	469	490	625	937	341
M24x3	36	353	164.98	432	396	495	554	594	622	792	1,188	432
M27x3	41	459	215.01	633	581	726	813	871	911	1,161	1,742	633
M30x3.5	46	561	262.37	858	787	984	1,102	1,181	1,236	1,574	2,361	858
M33x3.5	50	694	324.60	1,168	1,071	1,339	1,500	1,607	1,682	2,142	3,214	1,168
M36x4	55	817	382.25	1,500	1,376	1,720	1,927	2,064	2,160	2,752	4,128	1,500
M39x4	60	976	456.67	1,941	1,781	2,226	2,493	2,672	2,796	3,562	5,343	1,941
M42x4.5	65	1121	524.61	2,402	2,203	2,754	3,085	3,305	3,459	4,407	6,610	2,402
M45x4.5	70	1306	611.24	2,998	2,751	3,438	3,851	4,126	4,318	5,501	8,252	2,998
M48x5	75	1473	689.47	3,607	3,309	4,137	4,633	4,964	5,196	6,619	9,928	3,607
M52x5	80	1758	822.70	4,663	4,278	5,348	5,989	6,417	6,717	8,556	12,834	4,663
M56x5.5	85	2030	950.09	5,799	5,321	6,651	7,449	7,981	8,353	10,641	15,962	5,799
M60x5.5	90	2362	1,105.47	7,230	6,633	8,291	9,286	9,949	10,414	13,266	19,898	7,230
M64x6	95	2676	1,252.41	8,737	8,015	10,019	11,222	12,023	12,584	16,031	24,046	8,737
M68x6	100	3055	1,429.93	10,599	9,724	12,154	13,613	14,585	15,266	19,447	29,171	10,599
M72x6	105	3460	1,619.22	12,708	11,658	14,573	16,322	17,488	18,304	23,317	34,975	12,708
M76x6	110	3889	1,820.27	15,079	13,834	17,293	19,368	20,751	21,719	27,668	41,502	15,079
M80x6	115	4344	2,033.09	17,729	16,265	20,331	22,771	24,397	25,536	32,529	48,794	17,729
M90x6	130	5591	2,616.58	25,669	23,549	29,436	32,969	35,324	36,972	47,098	70,648	25,669
M100x6	145	6995	3,273.58	35,682	32,736	40,920	45,830	49,104	51,395	65,472	98,207	35,682
M110x6	155	8556	4,004.10	48,009	44,045	55,056	61,663	66,068	69,151	88,090	132,135	48,009
M125x6	180	11192	5,237.71	71,364	65,471	81,839	91,660	98,207	102,790	130,943	196,414	71,364

TORQUE GUIDE FOR MATERIAL STANDARD 1.4913								**REQUIRED TORQUE** (N-m)				
MINIMUM YIELD (Mpa)			780									
BOLT LOAD BASED ON			70	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	133.67	291	267	334	374	401	420	535	802	291
M22x2.5	32	303	165.66	397	364	456	510	547	572	729	1,093	397
M24x3	36	353	192.48	504	462	577	647	693	725	924	1,386	504
M27x3	41	459	250.85	738	677	847	948	1,016	1,063	1,355	2,032	738
M30x3.5	46	561	306.10	1,001	918	1,148	1,286	1,377	1,442	1,837	2,755	1,001
M33x3.5	50	694	378.70	1,362	1,250	1,562	1,750	1,875	1,962	2,499	3,749	1,362
M36x4	55	817	445.95	1,750	1,605	2,007	2,248	2,408	2,521	3,211	4,816	1,750
M39x4	60	976	532.79	2,265	2,078	2,597	2,909	3,117	3,262	4,156	6,234	2,265
M42x4.5	65	1121	612.05	2,802	2,571	3,213	3,599	3,856	4,036	5,141	7,712	2,802
M45x4.5	70	1306	713.11	3,498	3,209	4,011	4,493	4,813	5,038	6,418	9,627	3,498
M48x5	75	1473	804.38	4,209	3,861	4,826	5,405	5,792	6,062	7,722	11,583	4,209
M52x5	80	1758	959.82	5,440	4,991	6,239	6,987	7,487	7,836	9,982	14,973	5,440
M56x5.5	85	2030	1,108.44	6,766	6,207	7,759	8,690	9,311	9,745	12,415	18,622	6,766
M60x5.5	90	2362	1,289.72	8,435	7,738	9,673	10,834	11,607	12,149	15,477	23,215	8,435
M64x6	95	2676	1,461.14	10,193	9,351	11,689	13,092	14,027	14,682	18,703	28,054	10,193
M68x6	100	3055	1,668.26	12,365	11,344	14,180	15,882	17,016	17,810	22,688	34,032	12,365
M72x6	105	3460	1,889.09	14,826	13,601	17,002	19,042	20,402	21,354	27,203	40,804	14,826
M76x6	110	3889	2,123.65	17,592	16,140	20,175	22,596	24,210	25,339	32,280	48,419	17,592
M80x6	115	4344	2,371.93	20,683	18,975	23,719	26,566	28,463	29,791	37,951	56,926	20,683
M90x6	130	5591	3,052.67	29,947	27,474	34,343	38,464	41,211	43,134	54,948	82,422	29,947
M100x6	145	6995	3,819.18	41,629	38,192	47,740	53,468	57,288	59,961	76,384	114,575	41,629
M110x6	155	8556	4,671.45	56,011	51,386	64,232	71,940	77,079	80,676	102,772	154,158	56,011
M125x6	180	11192	6,110.67	83,258	76,383	95,479	106,937	114,575	119,922	152,767	229,150	83,258

TORQUE GUIDE FOR MATERIAL STANDARD 1.4913								**REQUIRED TORQUE** (N-m)				
MINIMUM YIELD (Mpa)			780									
BOLT LOAD BASED ON			80	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	152.76	333	306	382	428	458	480	611	917	333
M22x2.5	32	303	189.33	454	417	521	583	625	654	833	1,250	454
M24x3	36	353	219.98	575	528	660	739	792	829	1,056	1,584	575
M27x3	41	459	286.68	844	774	968	1,084	1,161	1,215	1,548	2,322	844
M30x3.5	46	561	349.83	1,144	1,049	1,312	1,469	1,574	1,648	2,099	3,148	1,144
M33x3.5	50	694	432.80	1,557	1,428	1,785	2,000	2,142	2,242	2,856	4,285	1,557
M36x4	55	817	509.66	2,000	1,835	2,293	2,569	2,752	2,881	3,670	5,504	2,000
M39x4	60	976	608.90	2,588	2,375	2,968	3,325	3,562	3,728	4,749	7,124	2,588
M42x4.5	65	1121	699.48	3,202	2,938	3,672	4,113	4,407	4,612	5,876	8,813	3,202
M45x4.5	70	1306	814.98	3,997	3,667	4,584	5,134	5,501	5,758	7,335	11,002	3,997
M48x5	75	1473	919.29	4,810	4,413	5,516	6,178	6,619	6,928	8,825	13,238	4,810
M52x5	80	1758	1,096.94	6,217	5,704	7,130	7,986	8,556	8,955	11,408	17,112	6,217
M56x5.5	85	2030	1,266.79	7,732	7,094	8,868	9,932	10,641	11,138	14,188	21,282	7,732
M60x5.5	90	2362	1,473.96	9,640	8,844	11,055	12,381	13,266	13,885	17,688	26,531	9,640
M64x6	95	2676	1,669.88	11,649	10,687	13,359	14,962	16,031	16,779	21,374	32,062	11,649
M68x6	100	3055	1,906.58	14,132	12,965	16,206	18,151	19,447	20,355	25,929	38,894	14,132
M72x6	105	3460	2,158.96	16,944	15,545	19,431	21,762	23,317	24,405	31,089	46,634	16,944
M76x6	110	3889	2,427.03	20,106	18,445	23,057	25,824	27,668	28,959	36,891	55,336	20,106
M80x6	115	4344	2,710.78	23,638	21,686	27,108	30,361	32,529	34,047	43,372	65,059	23,638
M90x6	130	5591	3,488.77	34,225	31,399	39,249	43,958	47,098	49,296	62,798	94,197	34,225
M100x6	145	6995	4,364.77	47,576	43,648	54,560	61,107	65,472	68,527	87,295	130,943	47,576
M110x6	155	8556	5,338.80	64,012	58,727	73,408	82,217	88,090	92,201	117,454	176,180	64,012
M125x6	180	11192	6,983.62	95,152	87,295	109,119	122,213	130,943	137,053	174,590	261,886	95,152

TORQUE GUIDE FOR MATERIAL STANDARD 1.4913

MINIMUM YIELD (Mpa) 780

BOLT LOAD BASED ON 90 PERCENT YIELD

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	171.86	375	344	430	481	516	540	687	1,031	375
M22x2.5	32	303	213.00	511	469	586	656	703	736	937	1,406	511
M24x3	36	353	247.47	647	594	742	832	891	932	1,188	1,782	647
M27x3	41	459	322.52	949	871	1,089	1,219	1,306	1,367	1,742	2,612	949
M30x3.5	46	561	393.55	1,287	1,181	1,476	1,653	1,771	1,854	2,361	3,542	1,287
M33x3.5	50	694	486.90	1,751	1,607	2,008	2,249	2,410	2,523	3,214	4,820	1,751
M36x4	55	817	573.37	2,250	2,064	2,580	2,890	3,096	3,241	4,128	6,192	2,250
M39x4	60	976	685.01	2,912	2,672	3,339	3,740	4,007	4,194	5,343	8,015	2,912
M42x4.5	65	1121	786.92	3,603	3,305	4,131	4,627	4,958	5,189	6,610	9,915	3,603
M45x4.5	70	1306	916.86	4,497	4,126	5,157	5,776	6,189	6,478	8,252	12,378	4,497
M48x5	75	1473	1,034.20	5,411	4,964	6,205	6,950	7,446	7,794	9,928	14,892	5,411
M52x5	80	1758	1,234.05	6,995	6,417	8,021	8,984	9,626	10,075	12,834	19,251	6,995
M56x5.5	85	2030	1,425.14	8,699	7,981	9,976	11,173	11,971	12,530	15,962	23,942	8,699
M60x5.5	90	2362	1,658.21	10,845	9,949	12,437	13,929	14,924	15,620	19,898	29,848	10,845
M64x6	95	2676	1,878.61	13,105	12,023	15,029	16,832	18,035	18,876	24,046	36,069	13,105
M68x6	100	3055	2,144.90	15,898	14,585	18,232	20,419	21,878	22,899	29,171	43,756	15,898
M72x6	105	3460	2,428.83	19,061	17,488	21,860	24,483	26,231	27,456	34,975	52,463	19,061
M76x6	110	3889	2,730.41	22,619	20,751	25,939	29,052	31,127	32,579	41,502	62,253	22,619
M80x6	115	4344	3,049.63	26,593	24,397	30,496	34,156	36,596	38,303	48,794	73,191	26,593
M90x6	130	5591	3,924.86	38,503	35,324	44,155	49,453	52,986	55,458	70,648	105,971	38,503
M100x6	145	6995	4,910.37	53,523	49,104	61,380	68,745	73,656	77,093	98,207	147,311	53,523
M110x6	155	8556	6,006.15	72,014	66,068	82,585	92,495	99,101	103,726	132,135	198,203	72,014
M125x6	180	11192	7,856.57	107,046	98,207	122,759	137,490	147,311	154,185	196,414	294,621	107,046

TORQUE GUIDE FOR MATERIAL STANDARD 1.4913

MINIMUM YIELD (Mpa) 780

BOLT LOAD BASED ON 99 PERCENT YIELD

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	189.04	412	378	473	529	567	594	756	1,134	412
M22x2.5	32	303	234.30	562	515	644	722	773	809	1,031	1,546	562
M24x3	36	353	272.22	712	653	817	915	980	1,026	1,307	1,960	712
M27x3	41	459	354.77	1,044	958	1,197	1,341	1,437	1,504	1,916	2,874	1,044
M30x3.5	46	561	432.91	1,416	1,299	1,623	1,818	1,948	2,039	2,597	3,896	1,416
M33x3.5	50	694	535.59	1,927	1,767	2,209	2,474	2,651	2,775	3,535	5,302	1,927
M36x4	55	817	630.70	2,475	2,271	2,838	3,179	3,406	3,565	4,541	6,812	2,475
M39x4	60	976	753.51	3,203	2,939	3,673	4,114	4,408	4,614	5,877	8,816	3,203
M42x4.5	65	1121	865.61	3,963	3,636	4,544	5,090	5,453	5,708	7,271	10,907	3,963
M45x4.5	70	1306	1,008.54	4,947	4,538	5,673	6,354	6,808	7,125	9,077	13,615	4,947
M48x5	75	1473	1,137.62	5,952	5,461	6,826	7,645	8,191	8,573	10,921	16,382	5,952
M52x5	80	1758	1,357.46	7,694	7,059	8,823	9,882	10,588	11,082	14,118	21,176	7,694
M56x5.5	85	2030	1,567.65	9,569	8,779	10,974	12,290	13,168	13,783	17,558	26,337	9,569
M60x5.5	90	2362	1,824.03	11,929	10,944	13,680	15,322	16,416	17,182	21,888	32,832	11,929
M64x6	95	2676	2,066.47	14,416	13,225	16,532	18,516	19,838	20,764	26,451	39,676	14,416
M68x6	100	3055	2,359.39	17,488	16,044	20,055	22,461	24,066	25,189	32,088	48,132	17,488
M72x6	105	3460	2,671.72	20,968	19,236	24,045	26,931	28,855	30,201	38,473	57,709	20,968
M76x6	110	3889	3,003.45	24,881	22,826	28,533	31,957	34,239	35,837	45,652	68,479	24,881
M80x6	115	4344	3,354.59	29,252	26,837	33,546	37,571	40,255	42,134	53,673	80,510	29,252
M90x6	130	5591	4,317.35	42,353	38,856	48,570	54,399	58,284	61,004	77,712	116,568	42,353
M100x6	145	6995	5,401.41	58,875	54,014	67,518	75,620	81,021	84,802	108,028	162,042	58,875
M110x6	155	8556	6,606.76	79,215	72,674	90,843	101,744	109,012	114,099	145,349	218,023	79,215
M125x6	180	11192	8,642.23	117,750	108,028	135,035	151,239	162,042	169,604	216,056	324,083	117,750

BOLT LOAD (METRIC) SOCKET HEAD CAP SCREWS (MATERIAL 1.4923)
40% - 99% YIELD

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR MATERIAL STANDARD 1.4923
MINIMUM YIELD (Mpa) 600
BOLT LOAD BASED ON 40 PERCENT YIELD

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	LoaDISC TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	58.75	128	118	147	165	176	184	235	353	128
M22x2.5	32	303	72.82	175	160	200	224	240	252	320	481	175
M24x3	36	353	84.61	221	203	254	284	305	319	406	609	221
M27x3	41	459	110.26	325	298	372	417	447	467	595	893	325
M30x3.5	46	561	134.55	440	404	505	565	605	634	807	1,211	440
M33x3.5	50	694	166.46	599	549	687	769	824	862	1,099	1,648	599
M36x4	55	817	196.02	769	706	882	988	1,059	1,108	1,411	2,117	769
M39x4	60	976	234.19	996	913	1,142	1,279	1,370	1,434	1,827	2,740	996
M42x4.5	65	1121	269.03	1,232	1,130	1,412	1,582	1,695	1,774	2,260	3,390	1,232
M45x4.5	70	1306	313.46	1,537	1,411	1,763	1,975	2,116	2,215	2,821	4,232	1,537
M48x5	75	1473	353.57	1,850	1,697	2,121	2,376	2,546	2,665	3,394	5,091	1,850
M52x5	80	1758	421.90	2,391	2,194	2,742	3,071	3,291	3,444	4,388	6,582	2,391
M56x5.5	85	2030	487.23	2,974	2,728	3,411	3,820	4,093	4,284	5,457	8,185	2,974
M60x5.5	90	2362	566.91	3,708	3,401	4,252	4,762	5,102	5,340	6,803	10,204	3,708
M64x6	95	2676	642.26	4,480	4,110	5,138	5,755	6,166	6,453	8,221	12,331	4,480
M68x6	100	3055	733.30	5,435	4,986	6,233	6,981	7,480	7,829	9,973	14,959	5,435
M72x6	105	3460	830.37	6,517	5,979	7,473	8,370	8,968	9,387	11,957	17,936	6,517
M76x6	110	3889	933.47	7,733	7,094	8,868	9,932	10,642	11,138	14,189	21,283	7,733
M80x6	115	4344	1,042.61	9,092	8,341	10,426	11,677	12,511	13,095	16,682	25,023	9,092
M90x6	130	5591	1,341.83	13,163	12,077	15,096	16,907	18,115	18,960	24,153	36,230	13,163
M100x6	145	6995	1,678.76	18,298	16,788	20,984	23,503	25,181	26,357	33,575	50,363	18,298
M110x6	155	8556	2,053.38	24,620	22,587	28,234	31,622	33,881	35,462	45,174	67,762	24,620
M125x6	180	11192	2,686.01	36,597	33,575	41,969	47,005	50,363	52,713	67,150	100,725	36,597

TORQUE GUIDE FOR MATERIAL STANDARD 1.4923						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			600									
BOLT LOAD BASED ON			50	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	73.44	160	147	184	206	220	231	294	441	160
M22x2.5	32	303	91.02	218	200	250	280	300	314	401	601	218
M24x3	36	353	105.76	277	254	317	355	381	398	508	761	277
M27x3	41	459	137.83	406	372	465	521	558	584	744	1,116	406
M30x3.5	46	561	168.19	550	505	631	706	757	792	1,009	1,514	550
M33x3.5	50	694	208.08	748	687	858	961	1,030	1,078	1,373	2,060	748
M36x4	55	817	245.03	961	882	1,103	1,235	1,323	1,385	1,764	2,646	961
M39x4	60	976	292.74	1,244	1,142	1,427	1,598	1,713	1,792	2,283	3,425	1,244
M42x4.5	65	1121	336.29	1,540	1,412	1,766	1,977	2,119	2,217	2,825	4,237	1,540
M45x4.5	70	1306	391.82	1,922	1,763	2,204	2,468	2,645	2,768	3,526	5,290	1,922
M48x5	75	1473	441.97	2,312	2,121	2,652	2,970	3,182	3,331	4,243	6,364	2,312
M52x5	80	1758	527.37	2,989	2,742	3,428	3,839	4,114	4,305	5,485	8,227	2,989
M56x5.5	85	2030	609.03	3,718	3,411	4,263	4,775	5,116	5,355	6,821	10,232	3,718
M60x5.5	90	2362	708.64	4,634	4,252	5,315	5,953	6,378	6,675	8,504	12,755	4,634
M64x6	95	2676	802.83	5,601	5,138	6,423	7,193	7,707	8,067	10,276	15,414	5,601
M68x6	100	3055	916.62	6,794	6,233	7,791	8,726	9,350	9,786	12,466	18,699	6,794
M72x6	105	3460	1,037.96	8,146	7,473	9,342	10,463	11,210	11,733	14,947	22,420	8,146
M76x6	110	3889	1,166.84	9,666	8,868	11,085	12,415	13,302	13,923	17,736	26,604	9,666
M80x6	115	4344	1,303.26	11,364	10,426	13,033	14,597	15,639	16,369	20,852	31,278	11,364
M90x6	130	5591	1,677.29	16,454	15,096	18,870	21,134	22,643	23,700	30,191	45,287	16,454
M100x6	145	6995	2,098.45	22,873	20,984	26,231	29,378	31,477	32,946	41,969	62,953	22,873
M110x6	155	8556	2,566.73	30,775	28,234	35,293	39,528	42,351	44,327	56,468	84,702	30,775
M125x6	180	11192	3,357.51	45,746	41,969	52,461	58,756	62,953	65,891	83,938	125,907	45,746

TORQUE GUIDE FOR MATERIAL STANDARD 1.4923						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			600									
BOLT LOAD BASED ON			60	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	88.13	192	176	220	247	264	277	353	529	192
M22x2.5	32	303	109.23	262	240	300	336	360	377	481	721	262
M24x3	36	353	126.91	332	305	381	426	457	478	609	914	332
M27x3	41	459	165.39	487	447	558	625	670	701	893	1,340	487
M30x3.5	46	561	201.82	660	605	757	848	908	951	1,211	1,816	660
M33x3.5	50	694	249.69	898	824	1,030	1,154	1,236	1,294	1,648	2,472	898
M36x4	55	817	294.03	1,154	1,059	1,323	1,482	1,588	1,662	2,117	3,176	1,154
M39x4	60	976	351.29	1,493	1,370	1,713	1,918	2,055	2,151	2,740	4,110	1,493
M42x4.5	65	1121	403.55	1,847	1,695	2,119	2,373	2,542	2,661	3,390	5,085	1,847
M45x4.5	70	1306	470.18	2,306	2,116	2,645	2,962	3,174	3,322	4,232	6,347	2,306
M48x5	75	1473	530.36	2,775	2,546	3,182	3,564	3,819	3,997	5,091	7,637	2,775
M52x5	80	1758	632.85	3,587	3,291	4,114	4,607	4,936	5,167	6,582	9,872	3,587
M56x5.5	85	2030	730.84	4,461	4,093	5,116	5,730	6,139	6,426	8,185	12,278	4,461
M60x5.5	90	2362	850.36	5,561	5,102	6,378	7,143	7,653	8,010	10,204	15,307	5,561
M64x6	95	2676	963.39	6,721	6,166	7,707	8,632	9,249	9,680	12,331	18,497	6,721
M68x6	100	3055	1,099.95	8,153	7,480	9,350	10,472	11,219	11,743	14,959	22,439	8,153
M72x6	105	3460	1,245.56	9,775	8,968	11,210	12,555	13,452	14,080	17,936	26,904	9,775
M76x6	110	3889	1,400.21	11,599	10,642	13,302	14,898	15,962	16,707	21,283	31,925	11,599
M80x6	115	4344	1,563.91	13,637	12,511	15,639	17,516	18,767	19,643	25,023	37,534	13,637
M90x6	130	5591	2,012.75	19,745	18,115	22,643	25,361	27,172	28,440	36,230	54,344	19,745
M100x6	145	6995	2,518.14	27,448	25,181	31,477	35,254	37,772	39,535	50,363	75,544	27,448
M110x6	155	8556	3,080.08	36,930	33,881	42,351	47,433	50,821	53,193	67,762	101,643	36,930

TORQUE GUIDE FOR MATERIAL STANDARD 1.4923						REQUIRED TORQUE (N-m)						
MINIMUM YIELD (Mpa)			600									
BOLT LOAD BASED ON			70	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	102.82	224	206	257	288	308	323	411	617	224
M22x2.5	32	303	127.43	306	280	350	392	421	440	561	841	306
M24x3	36	353	148.06	387	355	444	497	533	558	711	1,066	387
M27x3	41	459	192.96	568	521	651	729	781	818	1,042	1,563	568
M30x3.5	46	561	235.46	770	706	883	989	1,060	1,109	1,413	2,119	770
M33x3.5	50	694	291.31	1,048	961	1,202	1,346	1,442	1,509	1,923	2,884	1,048
M36x4	55	817	343.04	1,346	1,235	1,544	1,729	1,852	1,939	2,470	3,705	1,346
M39x4	60	976	409.84	1,742	1,598	1,998	2,238	2,398	2,509	3,197	4,795	1,742
M42x4.5	65	1121	470.81	2,155	1,977	2,472	2,768	2,966	3,104	3,955	5,932	2,155
M45x4.5	70	1306	548.55	2,691	2,468	3,086	3,456	3,703	3,875	4,937	7,405	2,691
M48x5	75	1473	618.75	3,237	2,970	3,713	4,158	4,455	4,663	5,940	8,910	3,237
M52x5	80	1758	738.32	4,185	3,839	4,799	5,375	5,759	6,028	7,679	11,518	4,185
M56x5.5	85	2030	852.65	5,205	4,775	5,969	6,685	7,162	7,496	9,550	14,324	5,205
M60x5.5	90	2362	992.09	6,488	5,953	7,441	8,334	8,929	9,345	11,905	17,858	6,488
M64x6	95	2676	1,123.96	7,841	7,193	8,992	10,071	10,790	11,294	14,387	21,580	7,841
M68x6	100	3055	1,283.27	9,512	8,726	10,908	12,217	13,089	13,700	17,453	26,179	9,512
M72x6	105	3460	1,453.15	11,404	10,463	13,078	14,648	15,694	16,426	20,925	31,388	11,404
M76x6	110	3889	1,633.58	13,533	12,415	15,519	17,381	18,623	19,492	24,830	37,246	13,533
M80x6	115	4344	1,824.56	15,910	14,597	18,246	20,435	21,895	22,917	29,193	43,790	15,910
M90x6	130	5591	2,348.21	23,036	21,134	26,417	29,587	31,701	33,180	42,268	63,402	23,036
M100x6	145	6995	2,937.83	32,022	29,378	36,723	41,130	44,067	46,124	58,757	88,135	32,022
M110x6	155	8556	3,593.42	43,085	39,528	49,410	55,339	59,291	62,058	79,055	118,583	43,085
M125x6	180	11192	4,700.51	64,044	58,756	73,445	82,259	88,135	92,248	117,513	176,269	64,044

TORQUE GUIDE FOR MATERIAL STANDARD 1.4923						REQUIRED TORQUE (N-m)						
MINIMUM YIELD (Mpa)			600									
BOLT LOAD BASED ON			80	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	117.51	256	235	294	329	353	369	470	705	256
M22x2.5	32	303	145.64	349	320	401	449	481	503	641	961	349
M24x3	36	353	169.21	443	406	508	569	609	638	812	1,218	443
M27x3	41	459	220.53	649	595	744	834	893	935	1,191	1,786	649
M30x3.5	46	561	269.10	880	807	1,009	1,130	1,211	1,267	1,615	2,422	880
M33x3.5	50	694	332.92	1,198	1,099	1,373	1,538	1,648	1,725	2,197	3,296	1,198
M36x4	55	817	392.05	1,538	1,411	1,764	1,976	2,117	2,216	2,823	4,234	1,538
M39x4	60	976	468.38	1,991	1,827	2,283	2,557	2,740	2,868	3,653	5,480	1,991
M42x4.5	65	1121	538.06	2,463	2,260	2,825	3,164	3,390	3,548	4,520	6,780	2,463
M45x4.5	70	1306	626.91	3,075	2,821	3,526	3,950	4,232	4,429	5,642	8,463	3,075
M48x5	75	1473	707.15	3,700	3,394	4,243	4,752	5,091	5,329	6,789	10,183	3,700
M52x5	80	1758	843.80	4,783	4,388	5,485	6,143	6,582	6,889	8,775	13,163	4,783
M56x5.5	85	2030	974.45	5,948	5,457	6,821	7,640	8,185	8,567	10,914	16,371	5,948
M60x5.5	90	2362	1,133.82	7,415	6,803	8,504	9,524	10,204	10,681	13,606	20,409	7,415
M64x6	95	2676	1,284.52	8,961	8,221	10,276	11,509	12,331	12,907	16,442	24,663	8,961
M68x6	100	3055	1,466.60	10,870	9,973	12,466	13,962	14,959	15,657	19,946	29,919	10,870
M72x6	105	3460	1,660.74	13,033	11,957	14,947	16,740	17,936	18,773	23,915	35,872	13,033
M76x6	110	3889	1,866.95	15,466	14,189	17,736	19,864	21,283	22,276	28,378	42,566	15,466
M80x6	115	4344	2,085.22	18,183	16,682	20,852	23,354	25,023	26,190	33,363	50,045	18,183
M90x6	130	5591	2,683.67	26,327	24,153	30,191	33,814	36,230	37,920	48,306	72,459	26,327
M100x6	145	6995	3,357.52	36,597	33,575	41,969	47,005	50,363	52,713	67,150	100,726	36,597
M110x6	155	8556	4,106.77	49,240	45,174	56,468	63,244	67,762	70,924	90,349	135,523	49,240
M125x6	180	11192	5,372.01	73,194	67,150	83,938	94,010	100,725	105,426	134,300	201,450	73,194

TORQUE GUIDE FOR MATERIAL STANDARD 1.4923						REQUIRED TORQUE (N-m)						
MINIMUM YIELD (Mpa)			600									
BOLT LOAD BASED ON			90	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	132.20	288	264	330	370	397	415	529	793	288
M22x2.5	32	303	163.84	393	360	451	505	541	566	721	1,081	393
M24x3	36	353	190.36	498	457	571	640	685	717	914	1,371	498
M27x3	41	459	248.09	730	670	837	938	1,005	1,052	1,340	2,010	730
M30x3.5	46	561	302.73	990	908	1,135	1,271	1,362	1,426	1,816	2,725	990
M33x3.5	50	694	374.54	1,347	1,236	1,545	1,730	1,854	1,940	2,472	3,708	1,347
M36x4	55	817	441.05	1,731	1,588	1,985	2,223	2,382	2,493	3,176	4,763	1,731
M39x4	60	976	526.93	2,240	2,055	2,569	2,877	3,083	3,226	4,110	6,165	2,240
M42x4.5	65	1121	605.32	2,771	2,542	3,178	3,559	3,814	3,991	5,085	7,627	2,771
M45x4.5	70	1306	705.27	3,459	3,174	3,967	4,443	4,761	4,983	6,347	9,521	3,459
M48x5	75	1473	795.54	4,162	3,819	4,773	5,346	5,728	5,995	7,637	11,456	4,162
M52x5	80	1758	949.27	5,380	4,936	6,170	6,911	7,404	7,750	9,872	14,809	5,380
M56x5.5	85	2030	1,096.26	6,692	6,139	7,674	8,595	9,209	9,638	12,278	18,417	6,692
M60x5.5	90	2362	1,275.54	8,342	7,653	9,567	10,715	11,480	12,016	15,307	22,960	8,342
M64x6	95	2676	1,445.09	10,081	9,249	11,561	12,948	13,873	14,520	18,497	27,746	10,081
M68x6	100	3055	1,649.92	12,229	11,219	14,024	15,707	16,829	17,615	22,439	33,658	12,229
M72x6	105	3460	1,868.33	14,663	13,452	16,815	18,833	20,178	21,120	26,904	40,356	14,663
M76x6	110	3889	2,100.32	17,399	15,962	19,953	22,347	23,944	25,061	31,925	47,887	17,399
M80x6	115	4344	2,345.87	20,456	18,767	23,459	26,274	28,150	29,464	37,534	56,301	20,456
M90x6	130	5591	3,019.13	29,618	27,172	33,965	38,041	40,758	42,660	54,344	81,516	29,618
M100x6	145	6995	3,777.21	41,172	37,772	47,215	52,881	56,658	59,302	75,544	113,316	41,172
M110x6	155	8556	4,620.11	55,395	50,821	63,527	71,150	76,232	79,789	101,643	152,464	55,395
M125x6	180	11192	6,043.51	82,343	75,544	94,430	105,762	113,316	118,604	151,088	226,632	82,343

TORQUE GUIDE FOR MATERIAL STANDARD 1.4923						REQUIRED TORQUE (N-m)						
MINIMUM YIELD (Mpa)			600									
BOLT LOAD BASED ON			99	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	145.42	317	291	364	407	436	457	582	872	317
M22x2.5	32	303	180.23	432	397	496	555	595	623	793	1,190	432
M24x3	36	353	209.40	548	503	628	704	754	789	1,005	1,508	548
M27x3	41	459	272.90	803	737	921	1,032	1,105	1,157	1,474	2,210	803
M30x3.5	46	561	333.01	1,089	999	1,249	1,399	1,499	1,568	1,998	2,997	1,089
M33x3.5	50	694	411.99	1,482	1,360	1,699	1,903	2,039	2,135	2,719	4,079	1,482
M36x4	55	817	485.16	1,904	1,747	2,183	2,445	2,620	2,742	3,493	5,240	1,904
M39x4	60	976	579.62	2,464	2,261	2,826	3,165	3,391	3,549	4,521	6,782	2,464
M42x4.5	65	1121	665.85	3,048	2,797	3,496	3,915	4,195	4,391	5,593	8,390	3,048
M45x4.5	70	1306	775.80	3,805	3,491	4,364	4,888	5,237	5,481	6,982	10,473	3,805
M48x5	75	1473	875.09	4,578	4,200	5,251	5,881	6,301	6,595	8,401	12,601	4,578
M52x5	80	1758	1,044.20	5,919	5,430	6,787	7,602	8,145	8,525	10,860	16,290	5,919
M56x5.5	85	2030	1,205.88	7,361	6,753	8,441	9,454	10,129	10,602	13,506	20,259	7,361
M60x5.5	90	2362	1,403.10	9,176	8,419	10,523	11,786	12,628	13,217	16,837	25,256	9,176
M64x6	95	2676	1,589.60	11,089	10,173	12,717	14,243	15,260	15,972	20,347	30,520	11,089
M68x6	100	3055	1,814.92	13,452	12,341	15,427	17,278	18,512	19,376	24,683	37,024	13,452
M72x6	105	3460	2,055.17	16,129	14,797	18,497	20,716	22,196	23,232	29,594	44,392	16,129
M76x6	110	3889	2,310.35	19,139	17,559	21,948	24,582	26,338	27,567	35,117	52,676	19,139
M80x6	115	4344	2,580.45	22,502	20,644	25,805	28,901	30,965	32,411	41,287	61,931	22,502
M90x6	130	5591	3,321.04	32,579	29,889	37,362	41,845	44,834	46,926	59,779	89,668	32,579
M100x6	145	6995	4,154.93	45,289	41,549	51,937	58,169	62,324	65,232	83,099	124,648	45,289
M110x6	155	8556	5,082.13	60,935	55,903	69,879	78,265	83,855	87,768	111,807	167,710	60,935
M125x6	180	11192	6,647.87	90,577	83,098	103,873	116,338	124,647	130,464	166,197	249,295	90,577

BOLT LOAD (METRIC) SOCKET HEAD CAP SCREWS (MATERIAL 1.4986)

40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR MATERIAL STANDARD 1.4986				REQUIRED TORQUE (N-m)								
MINIMUM YIELD (Mpa)			500									
BOLT LOAD BASED ON			40	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	LoaDISC TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	48.96	107	98	122	137	147	154	196	294	107
M22x2.5	32	303	60.68	146	134	167	187	200	210	267	401	146
M24x3	36	353	70.50	184	169	212	237	254	266	338	508	184
M27x3	41	459	91.89	270	248	310	347	372	390	496	744	270
M30x3.5	46	561	112.12	367	336	420	471	505	528	673	1,009	367
M33x3.5	50	694	138.72	499	458	572	641	687	719	916	1,373	499
M36x4	55	817	163.35	641	588	735	823	882	923	1,176	1,764	641
M39x4	60	976	195.16	830	761	951	1,066	1,142	1,195	1,522	2,283	830
M42x4.5	65	1121	224.19	1,026	942	1,177	1,318	1,412	1,478	1,883	2,825	1,026
M45x4.5	70	1306	261.21	1,281	1,175	1,469	1,646	1,763	1,845	2,351	3,526	1,281
M48x5	75	1473	294.64	1,542	1,414	1,768	1,980	2,121	2,220	2,829	4,243	1,542
M52x5	80	1758	351.58	1,993	1,828	2,285	2,560	2,742	2,870	3,656	5,485	1,993
M56x5.5	85	2030	406.02	2,478	2,274	2,842	3,183	3,411	3,570	4,547	6,821	2,478
M60x5.5	90	2362	472.42	3,090	2,835	3,543	3,968	4,252	4,450	5,669	8,504	3,090
M64x6	95	2676	535.22	3,734	3,425	4,282	4,796	5,138	5,378	6,851	10,276	3,734
M68x6	100	3055	611.08	4,529	4,155	5,194	5,818	6,233	6,524	8,311	12,466	4,529
M72x6	105	3460	691.98	5,431	4,982	6,228	6,975	7,473	7,822	9,964	14,947	5,431
M76x6	110	3889	777.89	6,444	5,912	7,390	8,277	8,868	9,282	11,824	17,736	6,444
M80x6	115	4344	868.84	7,576	6,951	8,688	9,731	10,426	10,913	13,901	20,852	7,576
M90x6	130	5591	1,118.20	10,969	10,064	12,580	14,089	15,096	15,800	20,128	30,191	10,969
M100x6	145	6995	1,398.97	15,249	13,990	17,487	19,586	20,984	21,964	27,979	41,969	15,249
M110x6	155	8556	1,711.15	20,517	18,823	23,528	26,352	28,234	29,552	37,645	56,468	20,517
M125x6	180	11192	2,238.34	30,497	27,979	34,974	39,171	41,969	43,927	55,958	83,938	30,497

TORQUE GUIDE FOR MATERIAL STANDARD 1.4986						**REQUIRED TORQUE** (N-m)							
MINIMUM YIELD (Mpa)			500										
BOLT LOAD BASED ON			50	PERCENT YIELD									
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	61.20	133	122	153	171	184	192	245	367	133
M22x2.5	32	303	75.85	182	167	209	234	250	262	334	501	182
M24x3	36	353	88.13	231	212	264	296	317	332	423	635	231
M27x3	41	459	114.86	338	310	388	434	465	487	620	930	338
M30x3.5	46	561	140.15	458	420	526	589	631	660	841	1,261	458
M33x3.5	50	694	173.40	624	572	715	801	858	898	1,144	1,717	624
M36x4	55	817	204.19	801	735	919	1,029	1,103	1,154	1,470	2,205	801
M39x4	60	976	243.95	1,037	951	1,189	1,332	1,427	1,494	1,903	2,854	1,037
M42x4.5	65	1121	280.24	1,283	1,177	1,471	1,648	1,766	1,848	2,354	3,531	1,283
M45x4.5	70	1306	326.52	1,602	1,469	1,837	2,057	2,204	2,307	2,939	4,408	1,602
M48x5	75	1473	368.30	1,927	1,768	2,210	2,475	2,652	2,776	3,536	5,304	1,927
M52x5	80	1758	439.48	2,491	2,285	2,857	3,199	3,428	3,588	4,571	6,856	2,491
M56x5.5	85	2030	507.53	3,098	2,842	3,553	3,979	4,263	4,462	5,684	8,526	3,098
M60x5.5	90	2362	590.53	3,862	3,543	4,429	4,960	5,315	5,563	7,086	10,630	3,862
M64x6	95	2676	669.02	4,667	4,282	5,352	5,994	6,423	6,722	8,563	12,845	4,667
M68x6	100	3055	763.85	5,662	5,194	6,493	7,272	7,791	8,155	10,388	15,583	5,662
M72x6	105	3460	864.97	6,788	6,228	7,785	8,719	9,342	9,778	12,456	18,683	6,788
M76x6	110	3889	972.37	8,055	7,390	9,237	10,346	11,085	11,602	14,780	22,170	8,055
M80x6	115	4344	1,086.05	9,470	8,688	10,861	12,164	13,033	13,641	17,377	26,065	9,470
M90x6	130	5591	1,397.74	13,712	12,580	15,725	17,612	18,870	19,750	25,159	37,739	13,712
M100x6	145	6995	1,748.71	19,061	17,487	21,859	24,482	26,231	27,455	34,974	52,461	19,061
M110x6	155	8556	2,138.94	25,646	23,528	29,410	32,940	35,293	36,940	47,057	70,585	25,646
M125x6	180	11192	2,797.92	38,122	34,974	43,718	48,964	52,461	54,909	69,948	104,922	38,122

TORQUE GUIDE FOR MATERIAL STANDARD 1.4986						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			500									
BOLT LOAD BASED ON			60	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	73.44	160	147	184	206	220	231	294	441	160
M22x2.5	32	303	91.02	218	200	250	280	300	314	401	601	218
M24x3	36	353	105.76	277	254	317	355	381	398	508	761	277
M27x3	41	459	137.83	406	372	465	521	558	584	744	1,116	406
M30x3.5	46	561	168.19	550	505	631	706	757	792	1,009	1,514	550
M33x3.5	50	694	208.08	748	687	858	961	1,030	1,078	1,373	2,060	748
M36x4	55	817	245.03	961	882	1,103	1,235	1,323	1,385	1,764	2,646	961
M39x4	60	976	292.74	1,244	1,142	1,427	1,598	1,713	1,792	2,283	3,425	1,244
M42x4.5	65	1121	336.29	1,540	1,412	1,766	1,977	2,119	2,217	2,825	4,237	1,540
M45x4.5	70	1306	391.82	1,922	1,763	2,204	2,468	2,645	2,768	3,526	5,290	1,922
M48x5	75	1473	441.97	2,312	2,121	2,652	2,970	3,182	3,331	4,243	6,364	2,312
M52x5	80	1758	527.37	2,989	2,742	3,428	3,839	4,114	4,305	5,485	8,227	2,989
M56x5.5	85	2030	609.03	3,718	3,411	4,263	4,775	5,116	5,355	6,821	10,232	3,718
M60x5.5	90	2362	708.64	4,634	4,252	5,315	5,953	6,378	6,675	8,504	12,755	4,634
M64x6	95	2676	802.83	5,601	5,138	6,423	7,193	7,707	8,067	10,276	15,414	5,601
M68x6	100	3055	916.62	6,794	6,233	7,791	8,726	9,350	9,786	12,466	18,699	6,794
M72x6	105	3460	1,037.96	8,146	7,473	9,342	10,463	11,210	11,733	14,947	22,420	8,146
M76x6	110	3889	1,166.84	9,666	8,868	11,085	12,415	13,302	13,923	17,736	26,604	9,666
M80x6	115	4344	1,303.26	11,364	10,426	13,033	14,597	15,639	16,369	20,852	31,278	11,364
M90x6	130	5591	1,677.29	16,454	15,096	18,870	21,134	22,643	23,700	30,191	45,287	16,454
M100x6	145	6995	2,098.45	22,873	20,984	26,231	29,378	31,477	32,946	41,969	62,953	22,873
M110x6	155	8556	2,566.73	30,775	28,234	35,293	39,528	42,351	44,327	56,468	84,702	30,775
M125x6	180	11192	3,357.51	45,746	41,969	52,461	58,756	62,953	65,891	83,938	125,907	45,746

TORQUE GUIDE FOR MATERIAL STANDARD 1.4986												
MINIMUM YIELD (Mpa)			500			**REQUIRED TORQUE** (N-m)						
BOLT LOAD BASED ON			70	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	85.68	187	171	214	240	257	269	343	514	187
M22x2.5	32	303	106.20	255	234	292	327	350	367	467	701	255
M24x3	36	353	123.38	323	296	370	415	444	465	592	888	323
M27x3	41	459	160.80	473	434	543	608	651	682	868	1,302	473
M30x3.5	46	561	196.22	642	589	736	824	883	924	1,177	1,766	642
M33x3.5	50	694	242.76	873	801	1,001	1,122	1,202	1,258	1,602	2,403	873
M36x4	55	817	285.87	1,122	1,029	1,286	1,441	1,544	1,616	2,058	3,087	1,122
M39x4	60	976	341.53	1,452	1,332	1,665	1,865	1,998	2,091	2,664	3,996	1,452
M42x4.5	65	1121	392.34	1,796	1,648	2,060	2,307	2,472	2,587	3,296	4,943	1,796
M45x4.5	70	1306	457.12	2,242	2,057	2,571	2,880	3,086	3,230	4,114	6,171	2,242
M48x5	75	1473	515.63	2,698	2,475	3,094	3,465	3,713	3,886	4,950	7,425	2,698
M52x5	80	1758	615.27	3,487	3,199	3,999	4,479	4,799	5,023	6,399	9,598	3,487
M56x5.5	85	2030	710.54	4,337	3,979	4,974	5,571	5,969	6,247	7,958	11,937	4,337
M60x5.5	90	2362	826.74	5,407	4,960	6,201	6,945	7,441	7,788	9,921	14,881	5,407
M64x6	95	2676	936.63	6,534	5,994	7,493	8,392	8,992	9,411	11,989	17,983	6,534
M68x6	100	3055	1,069.40	7,926	7,272	9,090	10,181	10,908	11,417	14,544	21,816	7,926
M72x6	105	3460	1,210.96	9,504	8,719	10,899	12,206	13,078	13,689	17,438	26,157	9,504
M76x6	110	3889	1,361.32	11,277	10,346	12,932	14,484	15,519	16,243	20,692	31,038	11,277
M80x6	115	4344	1,520.47	13,258	12,164	15,205	17,029	18,246	19,097	24,328	36,491	13,258
M90x6	130	5591	1,956.84	19,197	17,612	22,014	24,656	26,417	27,650	35,223	52,835	19,197
M100x6	145	6995	2,448.19	26,685	24,482	30,602	34,275	36,723	38,437	48,964	73,446	26,685
M110x6	155	8556	2,994.52	35,904	32,940	41,175	46,116	49,410	51,715	65,879	98,819	35,904
M125x6	180	11192	3,917.09	53,370	48,964	61,205	68,549	73,445	76,873	97,927	146,891	53,370

TORQUE GUIDE FOR MATERIAL STANDARD 1.4986												
MINIMUM YIELD (Mpa)			500			**REQUIRED TORQUE** (N-m)						
BOLT LOAD BASED ON			80	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	97.92	213	196	245	274	294	307	392	588	213
M22x2.5	32	303	121.37	291	267	334	374	401	419	534	801	291
M24x3	36	353	141.01	369	338	423	474	508	531	677	1,015	369
M27x3	41	459	183.77	541	496	620	695	744	779	992	1,489	541
M30x3.5	46	561	224.25	733	673	841	942	1,009	1,056	1,345	2,018	733
M33x3.5	50	694	277.43	998	916	1,144	1,282	1,373	1,437	1,831	2,747	998
M36x4	55	817	326.71	1,282	1,176	1,470	1,647	1,764	1,847	2,352	3,528	1,282
M39x4	60	976	390.32	1,659	1,522	1,903	2,131	2,283	2,390	3,044	4,567	1,659
M42x4.5	65	1121	448.39	2,053	1,883	2,354	2,637	2,825	2,957	3,766	5,650	2,053
M45x4.5	70	1306	522.43	2,562	2,351	2,939	3,291	3,526	3,691	4,702	7,053	2,562
M48x5	75	1473	589.29	3,083	2,829	3,536	3,960	4,243	4,441	5,657	8,486	3,083
M52x5	80	1758	703.16	3,986	3,656	4,571	5,119	5,485	5,741	7,313	10,969	3,986
M56x5.5	85	2030	812.04	4,957	4,547	5,684	6,366	6,821	7,139	9,095	13,642	4,957
M60x5.5	90	2362	944.85	6,179	5,669	7,086	7,937	8,504	8,900	11,338	17,007	6,179
M64x6	95	2676	1,070.43	7,467	6,851	8,563	9,591	10,276	10,756	13,702	20,552	7,467
M68x6	100	3055	1,222.17	9,059	8,311	10,388	11,635	12,466	13,048	16,621	24,932	9,059
M72x6	105	3460	1,383.95	10,861	9,964	12,456	13,950	14,947	15,644	19,929	29,893	10,861
M76x6	110	3889	1,555.79	12,888	11,824	14,780	16,554	17,736	18,564	23,648	35,472	12,888
M80x6	115	4344	1,737.68	15,153	13,901	17,377	19,462	20,852	21,825	27,803	41,704	15,153
M90x6	130	5591	2,236.39	21,939	20,128	25,159	28,179	30,191	31,600	40,255	60,383	21,939
M100x6	145	6995	2,797.93	30,497	27,979	34,974	39,171	41,969	43,928	55,959	83,938	30,497
M110x6	155	8556	3,422.31	41,033	37,645	47,057	52,704	56,468	59,103	75,291	112,936	41,033
M125x6	180	11192	4,476.68	60,995	55,958	69,948	78,342	83,938	87,855	111,917	167,875	60,995

TORQUE GUIDE FOR MATERIAL STANDARD 1.4986					REQUIRED TORQUE (N-m)							
MINIMUM YIELD (Mpa)			500									
BOLT LOAD BASED ON			90	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	110.16	240	220	275	308	330	346	441	661	240
M22x2.5	32	303	136.54	327	300	375	421	451	472	601	901	327
M24x3	36	353	158.64	415	381	476	533	571	598	761	1,142	415
M27x3	41	459	206.74	608	558	698	781	837	876	1,116	1,675	608
M30x3.5	46	561	252.28	825	757	946	1,060	1,135	1,188	1,514	2,270	825
M33x3.5	50	694	312.11	1,123	1,030	1,287	1,442	1,545	1,617	2,060	3,090	1,123
M36x4	55	817	367.54	1,442	1,323	1,654	1,852	1,985	2,077	2,646	3,969	1,442
M39x4	60	976	439.11	1,867	1,713	2,141	2,398	2,569	2,689	3,425	5,138	1,867
M42x4.5	65	1121	504.43	2,309	2,119	2,648	2,966	3,178	3,326	4,237	6,356	2,309
M45x4.5	70	1306	587.73	2,883	2,645	3,306	3,703	3,967	4,152	5,290	7,934	2,883
M48x5	75	1473	662.95	3,469	3,182	3,978	4,455	4,773	4,996	6,364	9,546	3,469
M52x5	80	1758	791.06	4,484	4,114	5,142	5,759	6,170	6,458	8,227	12,341	4,484
M56x5.5	85	2030	913.55	5,576	5,116	6,395	7,162	7,674	8,032	10,232	15,348	5,576
M60x5.5	90	2362	1,062.95	6,952	6,378	7,972	8,929	9,567	10,013	12,755	19,133	6,952
M64x6	95	2676	1,204.24	8,401	7,707	9,634	10,790	11,561	12,100	15,414	23,121	8,401
M68x6	100	3055	1,374.94	10,191	9,350	11,687	13,089	14,024	14,679	18,699	28,049	10,191
M72x6	105	3460	1,556.94	12,219	11,210	14,013	15,694	16,815	17,600	22,420	33,630	12,219
M76x6	110	3889	1,750.26	14,499	13,302	16,627	18,623	19,953	20,884	26,604	39,906	14,499
M80x6	115	4344	1,954.89	17,047	15,639	19,549	21,895	23,459	24,553	31,278	46,917	17,047
M90x6	130	5591	2,515.94	24,681	22,643	28,304	31,701	33,965	35,550	45,287	67,930	24,681
M100x6	145	6995	3,147.67	34,310	31,477	39,346	44,067	47,215	49,418	62,953	94,430	34,310
M110x6	155	8556	3,850.09	46,163	42,351	52,939	59,291	63,527	66,491	84,702	127,053	46,163
M125x6	180	11192	5,036.26	68,619	62,953	78,692	88,135	94,430	98,837	125,907	188,860	68,619

TORQUE GUIDE FOR MATERIAL STANDARD 1.4986					REQUIRED TORQUE (N-m)							
MINIMUM YIELD (Mpa)			500									
BOLT LOAD BASED ON			99	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	121.18	264	242	303	339	364	381	485	727	264
M22x2.5	32	303	150.19	360	330	413	463	496	519	661	991	360
M24x3	36	353	174.50	456	419	523	586	628	658	838	1,256	456
M27x3	41	459	227.42	669	614	768	860	921	964	1,228	1,842	669
M30x3.5	46	561	277.51	907	833	1,041	1,166	1,249	1,307	1,665	2,498	907
M33x3.5	50	694	343.33	1,235	1,133	1,416	1,586	1,699	1,779	2,266	3,399	1,235
M36x4	55	817	404.30	1,586	1,455	1,819	2,038	2,183	2,285	2,911	4,366	1,586
M39x4	60	976	483.02	2,053	1,884	2,355	2,637	2,826	2,958	3,768	5,651	2,053
M42x4.5	65	1121	554.88	2,540	2,330	2,913	3,263	3,496	3,659	4,661	6,991	2,540
M45x4.5	70	1306	646.50	3,171	2,909	3,637	4,073	4,364	4,568	5,819	8,728	3,171
M48x5	75	1473	729.24	3,815	3,500	4,375	4,901	5,251	5,496	7,001	10,501	3,815
M52x5	80	1758	870.17	4,932	4,525	5,656	6,335	6,787	7,104	9,050	13,575	4,932
M56x5.5	85	2030	1,004.90	6,134	5,627	7,034	7,878	8,441	8,835	11,255	16,882	6,134
M60x5.5	90	2362	1,169.25	7,647	7,015	8,769	9,822	10,523	11,014	14,031	21,046	7,647
M64x6	95	2676	1,324.66	9,241	8,478	10,597	11,869	12,717	13,310	16,956	25,434	9,241
M68x6	100	3055	1,512.43	11,210	10,285	12,856	14,398	15,427	16,147	20,569	30,854	11,210
M72x6	105	3460	1,712.64	13,441	12,331	15,414	17,263	18,497	19,360	24,662	36,993	13,441
M76x6	110	3889	1,925.29	15,949	14,632	18,290	20,485	21,948	22,973	29,264	43,897	15,949
M80x6	115	4344	2,150.38	18,751	17,203	21,504	24,084	25,805	27,009	34,406	51,609	18,751
M90x6	130	5591	2,767.53	27,149	24,908	31,135	34,871	37,362	39,105	49,816	74,723	27,149
M100x6	145	6995	3,462.44	37,741	34,624	43,281	48,474	51,937	54,360	69,249	103,873	37,741
M110x6	155	8556	4,235.10	50,779	46,586	58,233	65,221	69,879	73,140	93,172	139,758	50,779
M125x6	180	11192	5,539.89	75,481	69,249	86,561	96,948	103,873	108,720	138,497	207,746	75,481

BOLT LOAD (METRIC) SOCKET HEAD CAP SCREWS (MATERIAL 1.7258)

40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

TORQUE GUIDE FOR MATERIAL STANDARD **1.7258**

MINIMUM YIELD (Mpa) 440

BOLT LOAD BASED ON 40 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	LoaDISC TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	43.09	94	86	108	121	129	135	172	379	94
M22x2.5	32	303	53.40	128	117	147	164	176	184	235	517	128
M24x3	36	353	62.04	162	149	186	208	223	234	298	655	162
M27x3	41	459	80.86	238	218	273	306	327	343	437	961	238
M30x3.5	46	561	98.67	323	296	370	414	444	465	592	1,302	323
M33x3.5	50	694	122.07	439	403	504	564	604	632	806	1,772	439
M36x4	55	817	143.75	564	518	647	725	776	812	1,035	2,277	564
M39x4	60	976	171.74	730	670	837	938	1,005	1,052	1,340	2,947	730
M42x4.5	65	1121	197.29	903	829	1,036	1,160	1,243	1,301	1,657	3,646	903
M45x4.5	70	1306	229.87	1,127	1,034	1,293	1,448	1,552	1,624	2,069	4,551	1,127
M48x5	75	1473	259.29	1,357	1,245	1,556	1,742	1,867	1,954	2,489	5,476	1,357
M52x5	80	1758	309.39	1,754	1,609	2,011	2,252	2,413	2,526	3,218	7,079	1,754
M56x5.5	85	2030	357.30	2,181	2,001	2,501	2,801	3,001	3,141	4,002	8,804	2,181
M60x5.5	90	2362	415.73	2,719	2,494	3,118	3,492	3,742	3,916	4,989	10,975	2,719
M64x6	95	2676	470.99	3,286	3,014	3,768	4,220	4,522	4,733	6,029	13,263	3,286
M68x6	100	3055	537.75	3,986	3,657	4,571	5,119	5,485	5,741	7,313	16,090	3,986
M72x6	105	3460	608.94	4,779	4,384	5,480	6,138	6,577	6,883	8,769	19,291	4,779
M76x6	110	3889	684.55	5,671	5,203	6,503	7,284	7,804	8,168	10,405	22,891	5,671
M80x6	115	4344	764.58	6,667	6,117	7,646	8,563	9,175	9,603	12,233	26,913	6,667
M90x6	130	5591	984.01	9,653	8,856	11,070	12,399	13,284	13,904	17,712	38,967	9,653
M100x6	145	6995	1,231.09	13,419	12,311	15,389	17,235	18,466	19,328	24,622	54,168	13,419
M110x6	155	8556	1,505.81	18,055	16,564	20,705	23,190	24,846	26,005	33,128	72,881	18,055
M125x6	180	11192	1,969.74	26,838	24,622	30,777	34,470	36,933	38,656	49,243	108,336	26,838

TORQUE GUIDE FOR MATERIAL STANDARD **1.7258**

MINIMUM YIELD (Mpa) 440

BOLT LOAD BASED ON 50 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	LoaDISC TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	53.86	117	108	135	151	162	169	215	474	117
M22x2.5	32	303	66.75	160	147	184	206	220	231	294	646	160
M24x3	36	353	77.56	203	186	233	261	279	292	372	819	203
M27x3	41	459	101.07	297	273	341	382	409	428	546	1,201	297
M30x3.5	46	561	123.34	403	370	463	518	555	581	740	1,628	403
M33x3.5	50	694	152.59	549	504	629	705	755	791	1,007	2,216	549
M36x4	55	817	179.69	705	647	809	906	970	1,016	1,294	2,846	705
M39x4	60	976	214.68	913	837	1,047	1,172	1,256	1,314	1,674	3,684	913
M42x4.5	65	1121	246.61	1,129	1,036	1,295	1,450	1,554	1,626	2,072	4,557	1,129
M45x4.5	70	1306	287.33	1,409	1,293	1,616	1,810	1,940	2,030	2,586	5,689	1,409
M48x5	75	1473	324.11	1,696	1,556	1,945	2,178	2,334	2,442	3,111	6,845	1,696
M52x5	80	1758	386.74	2,192	2,011	2,514	2,815	3,017	3,157	4,022	8,849	2,192
M56x5.5	85	2030	446.62	2,726	2,501	3,126	3,502	3,752	3,927	5,002	11,005	2,726
M60x5.5	90	2362	519.67	3,399	3,118	3,897	4,365	4,677	4,895	6,236	13,719	3,399
M64x6	95	2676	588.74	4,107	3,768	4,710	5,275	5,652	5,916	7,536	16,579	4,107
M68x6	100	3055	672.19	4,982	4,571	5,714	6,399	6,856	7,176	9,142	20,112	4,982
M72x6	105	3460	761.17	5,974	5,480	6,851	7,673	8,221	8,604	10,961	24,114	5,974
M76x6	110	3889	855.68	7,088	6,503	8,129	9,104	9,755	10,210	13,006	28,614	7,088
M80x6	115	4344	955.72	8,334	7,646	9,557	10,704	11,469	12,004	15,292	33,641	8,334
M90x6	130	5591	1,230.01	12,066	11,070	13,838	15,498	16,605	17,380	22,140	48,709	12,066
M100x6	145	6995	1,538.86	16,774	15,389	19,236	21,544	23,083	24,160	30,777	67,710	16,774
M110x6	155	8556	1,882.27	22,568	20,705	25,881	28,987	31,057	32,507	41,410	91,102	22,568

TORQUE GUIDE FOR MATERIAL STANDARD **1.7258**

MINIMUM YIELD (Mpa) 440

BOLT LOAD BASED ON 60 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	64.63	141	129	162	181	194	203	259	569	141
M22x2.5	32	303	80.10	192	176	220	247	264	277	352	775	192
M24x3	36	353	93.07	243	223	279	313	335	351	447	983	243
M27x3	41	459	121.29	357	327	409	458	491	514	655	1,441	357
M30x3.5	46	561	148.00	484	444	555	622	666	697	888	1,954	484
M33x3.5	50	694	183.11	659	604	755	846	906	949	1,209	2,659	659
M36x4	55	817	215.63	846	776	970	1,087	1,164	1,219	1,553	3,416	846
M39x4	60	976	257.61	1,095	1,005	1,256	1,407	1,507	1,577	2,009	4,421	1,095
M42x4.5	65	1121	295.93	1,355	1,243	1,554	1,740	1,864	1,951	2,486	5,469	1,355
M45x4.5	70	1306	344.80	1,691	1,552	1,940	2,172	2,327	2,436	3,103	6,827	1,691
M48x5	75	1473	388.93	2,035	1,867	2,334	2,614	2,800	2,931	3,734	8,214	2,035
M52x5	80	1758	464.09	2,630	2,413	3,017	3,379	3,620	3,789	4,827	10,618	2,630
M56x5.5	85	2030	535.95	3,271	3,001	3,752	4,202	4,502	4,712	6,003	13,206	3,271
M60x5.5	90	2362	623.60	4,078	3,742	4,677	5,238	5,612	5,874	7,483	16,463	4,078
M64x6	95	2676	706.49	4,928	4,522	5,652	6,330	6,782	7,099	9,043	19,895	4,928
M68x6	100	3055	806.63	5,979	5,485	6,856	7,679	8,228	8,612	10,970	24,134	5,979
M72x6	105	3460	913.41	7,168	6,577	8,221	9,207	9,865	10,325	13,153	28,937	7,168
M76x6	110	3889	1,026.82	8,506	7,804	9,755	10,925	11,706	12,252	15,608	34,337	8,506
M80x6	115	4344	1,146.87	10,001	9,175	11,469	12,845	13,762	14,405	18,350	40,370	10,001
M90x6	130	5591	1,476.02	14,480	13,284	16,605	18,598	19,926	20,856	26,568	58,450	14,480
M100x6	145	6995	1,846.64	20,128	18,466	23,083	25,853	27,700	28,992	36,933	81,252	20,128
M110x6	155	8556	2,258.72	27,082	24,846	31,057	34,784	37,269	39,008	49,692	109,322	27,082
M125x6	180	11192	2,954.61	40,257	36,933	46,166	51,706	55,399	57,984	73,865	162,503	40,257

TORQUE GUIDE FOR MATERIAL STANDARD **1.7258**

MINIMUM YIELD (Mpa) 440

BOLT LOAD BASED ON 70 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	75.40	164	151	189	211	226	237	302	664	164
M22x2.5	32	303	93.45	224	206	257	288	308	323	411	905	224
M24x3	36	353	108.58	284	261	326	365	391	409	521	1,147	284
M27x3	41	459	141.50	416	382	478	535	573	600	764	1,681	416
M30x3.5	46	561	172.67	565	518	648	725	777	813	1,036	2,279	565
M33x3.5	50	694	213.62	768	705	881	987	1,057	1,107	1,410	3,102	768
M36x4	55	817	251.56	987	906	1,132	1,268	1,358	1,422	1,811	3,985	987
M39x4	60	976	300.55	1,278	1,172	1,465	1,641	1,758	1,840	2,344	5,157	1,278
M42x4.5	65	1121	345.26	1,581	1,450	1,813	2,030	2,175	2,277	2,900	6,380	1,581
M45x4.5	70	1306	402.27	1,973	1,810	2,263	2,534	2,715	2,842	3,620	7,965	1,973
M48x5	75	1473	453.75	2,374	2,178	2,723	3,049	3,267	3,419	4,356	9,583	2,374
M52x5	80	1758	541.44	3,069	2,815	3,519	3,942	4,223	4,420	5,631	12,388	3,069
M56x5.5	85	2030	625.27	3,817	3,502	4,377	4,902	5,252	5,497	7,003	15,407	3,817
M60x5.5	90	2362	727.53	4,758	4,365	5,456	6,111	6,548	6,853	8,730	19,207	4,758
M64x6	95	2676	824.23	5,750	5,275	6,594	7,385	7,913	8,282	10,550	23,210	5,750
M68x6	100	3055	941.07	6,975	6,399	7,999	8,959	9,599	10,047	12,799	28,157	6,975
M72x6	105	3460	1,065.64	8,363	7,673	9,591	10,742	11,509	12,046	15,345	33,760	8,363
M76x6	110	3889	1,197.96	9,924	9,104	11,381	12,746	13,657	14,294	18,209	40,060	9,924
M80x6	115	4344	1,338.01	11,667	10,704	13,380	14,986	16,056	16,805	21,408	47,098	11,667
M90x6	130	5591	1,722.02	16,893	15,498	19,373	21,697	23,247	24,332	30,996	68,192	16,893
M100x6	145	6995	2,154.41	23,483	21,544	26,930	30,162	32,316	33,824	43,088	94,794	23,483
M110x6	155	8556	2,635.18	31,596	28,987	36,234	40,582	43,480	45,509	57,974	127,543	31,596
M125x6	180	11192	3,447.04	46,966	43,088	53,860	60,323	64,632	67,648	86,176	189,587	46,966

TORQUE GUIDE FOR MATERIAL STANDARD **1.7258**
MINIMUM YIELD (Mpa) 440
BOLT LOAD BASED ON 80 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	86.17	188	172	215	241	259	271	345	758	188
M22x2.5	32	303	106.80	256	235	294	329	352	369	470	1,034	256
M24x3	36	353	124.09	325	298	372	417	447	468	596	1,310	325
M27x3	41	459	161.72	476	437	546	611	655	686	873	1,921	476
M30x3.5	46	561	197.34	645	592	740	829	888	929	1,184	2,605	645
M33x3.5	50	694	244.14	878	806	1,007	1,128	1,209	1,265	1,611	3,545	878
M36x4	55	817	287.50	1,128	1,035	1,294	1,449	1,553	1,625	2,070	4,554	1,128
M39x4	60	976	343.48	1,460	1,340	1,674	1,875	2,009	2,103	2,679	5,894	1,460
M42x4.5	65	1121	394.58	1,806	1,657	2,072	2,320	2,486	2,602	3,314	7,292	1,806
M45x4.5	70	1306	459.73	2,255	2,069	2,586	2,896	3,103	3,248	4,138	9,103	2,255
M48x5	75	1473	518.57	2,713	2,489	3,111	3,485	3,734	3,908	4,978	10,952	2,713
M52x5	80	1758	618.78	3,507	3,218	4,022	4,505	4,827	5,052	6,435	14,158	3,507
M56x5.5	85	2030	714.60	4,362	4,002	5,002	5,602	6,003	6,283	8,003	17,608	4,362
M60x5.5	90	2362	831.47	5,438	4,989	6,236	6,984	7,483	7,832	9,978	21,951	5,438
M64x6	95	2676	941.98	6,571	6,029	7,536	8,440	9,043	9,465	12,057	26,526	6,571
M68x6	100	3055	1,075.51	7,972	7,313	9,142	10,239	10,970	11,482	14,627	32,179	7,972
M72x6	105	3460	1,217.88	9,558	8,769	10,961	12,276	13,153	13,767	17,537	38,582	9,558
M76x6	110	3889	1,369.09	11,342	10,405	13,006	14,567	15,608	16,336	20,810	45,783	11,342
M80x6	115	4344	1,529.16	13,334	12,233	15,292	17,127	18,350	19,206	24,467	53,826	13,334
M90x6	130	5591	1,968.02	19,306	17,712	22,140	24,797	26,568	27,808	35,424	77,934	19,306
M100x6	145	6995	2,462.18	26,838	24,622	30,777	34,471	36,933	38,656	49,244	108,336	26,838
M110x6	155	8556	3,011.63	36,109	33,128	41,410	46,379	49,692	52,011	66,256	145,763	36,109
M125x6	180	11192	3,939.48	53,675	49,243	61,554	68,941	73,865	77,312	98,487	216,671	53,675

TORQUE GUIDE FOR MATERIAL STANDARD **1.7258**
MINIMUM YIELD (Mpa) 440
BOLT LOAD BASED ON 90 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	96.94	211	194	242	271	291	304	388	853	211
M22x2.5	32	303	120.15	288	264	330	370	397	415	529	1,163	288
M24x3	36	353	139.60	365	335	419	469	503	526	670	1,474	365
M27x3	41	459	181.93	535	491	614	688	737	771	982	2,161	535
M30x3.5	46	561	222.00	726	666	833	932	999	1,046	1,332	2,930	726
M33x3.5	50	694	274.66	988	906	1,133	1,269	1,360	1,423	1,813	3,988	988
M36x4	55	817	323.44	1,269	1,164	1,455	1,630	1,747	1,828	2,329	5,123	1,269
M39x4	60	976	386.42	1,643	1,507	1,884	2,110	2,261	2,366	3,014	6,631	1,643
M42x4.5	65	1121	443.90	2,032	1,864	2,330	2,610	2,797	2,927	3,729	8,203	2,032
M45x4.5	70	1306	517.20	2,537	2,327	2,909	3,258	3,491	3,654	4,655	10,241	2,537
M48x5	75	1473	583.39	3,052	2,800	3,500	3,920	4,200	4,396	5,601	12,321	3,052
M52x5	80	1758	696.13	3,946	3,620	4,525	5,068	5,430	5,683	7,240	15,928	3,946
M56x5.5	85	2030	803.92	4,907	4,502	5,627	6,303	6,753	7,068	9,004	19,809	4,907
M60x5.5	90	2362	935.40	6,118	5,612	7,015	7,857	8,419	8,811	11,225	24,695	6,118
M64x6	95	2676	1,059.73	7,393	6,782	8,478	9,495	10,173	10,648	13,565	29,842	7,393
M68x6	100	3055	1,209.94	8,968	8,228	10,285	11,519	12,341	12,917	16,455	36,202	8,968
M72x6	105	3460	1,370.11	10,753	9,865	12,331	13,811	14,797	15,488	19,730	43,405	10,753
M76x6	110	3889	1,540.23	12,759	11,706	14,632	16,388	17,559	18,378	23,412	51,505	12,759
M80x6	115	4344	1,720.30	15,001	13,762	17,203	19,267	20,644	21,607	27,525	60,555	15,001
M90x6	130	5591	2,214.03	21,720	19,926	24,908	27,897	29,889	31,284	39,852	87,675	21,720
M100x6	145	6995	2,769.95	30,192	27,700	34,624	38,779	41,549	43,488	55,399	121,878	30,192
M110x6	155	8556	3,388.08	40,623	37,269	46,586	52,176	55,903	58,512	74,538	163,983	40,623
M125x6	180	11192	4,431.91	60,385	55,399	69,249	77,558	83,098	86,976	110,798	243,755	60,385

TORQUE GUIDE FOR MATERIAL STANDARD **1.7258**

MINIMUM YIELD (Mpa) 440

BOLT LOAD BASED ON 99 PERCENT YIELD

BOLT LOADS

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	REQUIRED TORQUE (N-m)								
				LoaDISC TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	106.64	232	213	267	299	320	335	427	938	232
M22x2.5	32	303	132.17	317	291	363	407	436	457	582	1,279	317
M24x3	36	353	153.56	402	369	461	516	553	579	737	1,622	402
M27x3	41	459	200.13	589	540	675	756	811	848	1,081	2,378	589
M30x3.5	46	561	244.20	799	733	916	1,026	1,099	1,150	1,465	3,224	799
M33x3.5	50	694	302.13	1,087	997	1,246	1,396	1,496	1,565	1,994	4,387	1,087
M36x4	55	817	355.78	1,396	1,281	1,601	1,793	1,921	2,011	2,562	5,636	1,396
M39x4	60	976	425.06	1,807	1,658	2,072	2,321	2,487	2,603	3,315	7,294	1,807
M42x4.5	65	1121	488.29	2,235	2,051	2,564	2,871	3,076	3,220	4,102	9,024	2,235
M45x4.5	70	1306	568.92	2,791	2,560	3,200	3,584	3,840	4,019	5,120	11,265	2,791
M48x5	75	1473	641.73	3,358	3,080	3,850	4,312	4,620	4,836	6,161	13,553	3,358
M52x5	80	1758	765.75	4,340	3,982	4,977	5,575	5,973	6,252	7,964	17,520	4,340
M56x5.5	85	2030	884.31	5,398	4,952	6,190	6,933	7,428	7,775	9,904	21,790	5,398
M60x5.5	90	2362	1,028.94	6,729	6,174	7,717	8,643	9,260	9,693	12,347	27,164	6,729
M64x6	95	2676	1,165.70	8,132	7,460	9,326	10,445	11,191	11,713	14,921	32,826	8,132
M68x6	100	3055	1,330.94	9,865	9,050	11,313	12,671	13,576	14,209	18,101	39,822	9,865
M72x6	105	3460	1,507.12	11,828	10,851	13,564	15,192	16,277	17,037	21,703	47,746	11,828
M76x6	110	3889	1,694.25	14,035	12,876	16,095	18,027	19,314	20,216	25,753	56,656	14,035
M80x6	115	4344	1,892.33	16,501	15,139	18,923	21,194	22,708	23,768	30,277	66,610	16,501
M90x6	130	5591	2,435.43	23,892	21,919	27,399	30,686	32,878	34,413	43,838	96,443	23,892
M100x6	145	6995	3,046.95	33,212	30,469	38,087	42,657	45,704	47,837	60,939	134,066	33,212
M110x6	155	8556	3,726.89	44,685	40,996	51,245	57,394	61,494	64,363	81,992	180,382	44,685
M125x6	180	11192	4,875.10	66,423	60,939	76,173	85,314	91,408	95,674	121,878	268,131	66,423

BOLT LOAD (METRIC) SOCKET HEAD CAP SCREWS (MATERIAL 1.7709)

40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR MATERIAL STANDARD 1.7709				
MINIMUM YIELD (Mpa)	550		**REQUIRED TORQUE** (N-m)	
BOLT LOAD BASED ON	40	PERCENT YIELD		

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) K=.300 0.109
M20x2.5	30	245	53.86	117	108	135	151	162	169	215	323	117
M22x2.5	32	303	66.75	160	147	184	206	220	231	294	441	160
M24x3	36	353	77.56	203	186	233	261	279	292	372	558	203
M27x3	41	459	101.07	297	273	341	382	409	428	546	819	297
M30x3.5	46	561	123.34	403	370	463	518	555	581	740	1,110	403
M33x3.5	50	694	152.59	549	504	629	705	755	791	1,007	1,511	549
M36x4	55	817	179.69	705	647	809	906	970	1,016	1,294	1,941	705
M39x4	60	976	214.68	913	837	1,047	1,172	1,256	1,314	1,674	2,512	913
M42x4.5	65	1121	246.61	1,129	1,036	1,295	1,450	1,554	1,626	2,072	3,107	1,129
M45x4.5	70	1306	287.33	1,409	1,293	1,616	1,810	1,940	2,030	2,586	3,879	1,409
M48x5	75	1473	324.11	1,696	1,556	1,945	2,178	2,334	2,442	3,111	4,667	1,696
M52x5	80	1758	386.74	2,192	2,011	2,514	2,815	3,017	3,157	4,022	6,033	2,192
M56x5.5	85	2030	446.62	2,726	2,501	3,126	3,502	3,752	3,927	5,002	7,503	2,726
M60x5.5	90	2362	519.67	3,399	3,118	3,897	4,365	4,677	4,895	6,236	9,354	3,399
M64x6	95	2676	588.74	4,107	3,768	4,710	5,275	5,652	5,916	7,536	11,304	4,107
M68x6	100	3055	672.19	4,982	4,571	5,714	6,399	6,856	7,176	9,142	13,713	4,982
M72x6	105	3460	761.17	5,974	5,480	6,851	7,673	8,221	8,604	10,961	16,441	5,974
M76x6	110	3889	855.68	7,088	6,503	8,129	9,104	9,755	10,210	13,006	19,510	7,088
M80x6	115	4344	955.72	8,334	7,646	9,557	10,704	11,469	12,004	15,292	22,937	8,334
M90x6	130	5591	1,230.01	12,066	11,070	13,838	15,498	16,605	17,380	22,140	33,210	12,066
M100x6	145	6995	1,538.86	16,774	15,389	19,236	21,544	23,083	24,160	30,777	46,166	16,774
M110x6	155	8556	1,882.27	22,568	20,705	25,881	28,987	31,057	32,507	41,410	62,115	22,568
M125x6	180	11192	2,462.17	33,547	30,777	38,471	43,088	46,166	48,320	61,554	92,331	33,547

TORQUE GUIDE FOR MATERIAL STANDARD 1.7709						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			550									
BOLT LOAD BASED ON			50	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) K=.300
												0.109
M20x2.5	30	245	67.32	147	135	168	189	202	211	269	404	147
M22x2.5	32	303	83.44	200	184	229	257	275	288	367	551	200
M24x3	36	353	96.94	254	233	291	326	349	365	465	698	254
M27x3	41	459	126.34	372	341	426	478	512	536	682	1,023	372
M30x3.5	46	561	154.17	504	463	578	648	694	726	925	1,388	504
M33x3.5	50	694	190.74	686	629	787	881	944	988	1,259	1,888	686
M36x4	55	817	224.61	881	809	1,011	1,132	1,213	1,269	1,617	2,426	881
M39x4	60	976	268.34	1,141	1,047	1,308	1,465	1,570	1,643	2,093	3,140	1,141
M42x4.5	65	1121	308.27	1,411	1,295	1,618	1,813	1,942	2,033	2,589	3,884	1,411
M45x4.5	70	1306	359.17	1,762	1,616	2,020	2,263	2,424	2,538	3,233	4,849	1,762
M48x5	75	1473	405.14	2,120	1,945	2,431	2,723	2,917	3,053	3,889	5,834	2,120
M52x5	80	1758	483.43	2,740	2,514	3,142	3,519	3,771	3,947	5,028	7,541	2,740
M56x5.5	85	2030	558.28	3,408	3,126	3,908	4,377	4,690	4,908	6,253	9,379	3,408
M60x5.5	90	2362	649.58	4,248	3,897	4,872	5,456	5,846	6,119	7,795	11,692	4,248
M64x6	95	2676	735.92	5,134	4,710	5,887	6,594	7,065	7,395	9,420	14,130	5,134
M68x6	100	3055	840.24	6,228	5,714	7,142	7,999	8,570	8,970	11,427	17,141	6,228
M72x6	105	3460	951.47	7,467	6,851	8,563	9,591	10,276	10,755	13,701	20,552	7,467
M76x6	110	3889	1,069.60	8,861	8,129	10,161	11,381	12,193	12,763	16,258	24,387	8,861
M80x6	115	4344	1,194.66	10,417	9,557	11,947	13,380	14,336	15,005	19,114	28,672	10,417
M90x6	130	5591	1,537.52	15,083	13,838	17,297	19,373	20,756	21,725	27,675	41,513	15,083
M100x6	145	6995	1,923.58	20,967	19,236	24,045	26,930	28,854	30,200	38,472	57,707	20,967
M110x6	155	8556	2,352.84	28,211	25,881	32,351	36,234	38,822	40,633	51,762	77,644	28,211
M125x6	180	11192	3,077.72	41,934	38,471	48,089	53,860	57,707	60,400	76,943	115,414	41,934

TORQUE GUIDE FOR MATERIAL STANDARD 1.7709						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			550									
BOLT LOAD BASED ON			60	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) K=.300
												0.109
M20x2.5	30	245	80.79	176	162	202	226	242	254	323	485	176
M22x2.5	32	303	100.13	240	220	275	308	330	346	441	661	240
M24x3	36	353	116.33	304	279	349	391	419	438	558	838	304
M27x3	41	459	151.61	446	409	512	573	614	643	819	1,228	446
M30x3.5	46	561	185.00	605	555	694	777	833	871	1,110	1,665	605
M33x3.5	50	694	228.88	823	755	944	1,057	1,133	1,186	1,511	2,266	823
M36x4	55	817	269.53	1,058	970	1,213	1,358	1,455	1,523	1,941	2,911	1,058
M39x4	60	976	322.01	1,369	1,256	1,570	1,758	1,884	1,972	2,512	3,768	1,369
M42x4.5	65	1121	369.92	1,693	1,554	1,942	2,175	2,330	2,439	3,107	4,661	1,693
M45x4.5	70	1306	431.00	2,114	1,940	2,424	2,715	2,909	3,045	3,879	5,819	2,114
M48x5	75	1473	486.16	2,544	2,334	2,917	3,267	3,500	3,664	4,667	7,001	2,544
M52x5	80	1758	580.11	3,288	3,017	3,771	4,223	4,525	4,736	6,033	9,050	3,288
M56x5.5	85	2030	669.94	4,089	3,752	4,690	5,252	5,627	5,890	7,503	11,255	4,089
M60x5.5	90	2362	779.50	5,098	4,677	5,846	6,548	7,015	7,343	9,354	14,031	5,098
M64x6	95	2676	883.11	6,161	5,652	7,065	7,913	8,478	8,873	11,304	16,956	6,161
M68x6	100	3055	1,008.29	7,473	6,856	8,570	9,599	10,285	10,764	13,713	20,569	7,473
M72x6	105	3460	1,141.76	8,961	8,221	10,276	11,509	12,331	12,906	16,441	24,662	8,961
M76x6	110	3889	1,283.53	10,633	9,755	12,193	13,657	14,632	15,315	19,510	29,264	10,633
M80x6	115	4344	1,433.59	12,501	11,469	14,336	16,056	17,203	18,006	22,937	34,406	12,501
M90x6	130	5591	1,845.02	18,100	16,605	20,756	23,247	24,908	26,070	33,210	49,816	18,100
M100x6	145	6995	2,308.29	25,160	23,083	28,854	32,316	34,624	36,240	46,166	69,249	25,160
M110x6	155	8556	2,823.40	33,853	31,057	38,822	43,480	46,586	48,760	62,115	93,172	33,853
M125x6	180	11192	3,693.26	50,321	46,166	57,707	64,632	69,249	72,480	92,331	138,497	50,321

TORQUE GUIDE FOR MATERIAL STANDARD 1.7709						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			550									
BOLT LOAD BASED ON			70	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) K=.300
												0.109
M20x2.5	30	245	94.25	205	189	236	264	283	296	377	566	205
M22x2.5	32	303	116.81	280	257	321	360	385	403	514	771	280
M24x3	36	353	135.72	355	326	407	456	489	511	651	977	355
M27x3	41	459	176.88	521	478	597	669	716	750	955	1,433	521
M30x3.5	46	561	215.84	706	648	809	907	971	1,017	1,295	1,943	706
M33x3.5	50	694	267.03	961	881	1,102	1,234	1,322	1,383	1,762	2,644	961
M36x4	55	817	314.45	1,234	1,132	1,415	1,585	1,698	1,777	2,264	3,396	1,234
M39x4	60	976	375.68	1,597	1,465	1,831	2,051	2,198	2,300	2,930	4,395	1,597
M42x4.5	65	1121	431.57	1,976	1,813	2,266	2,538	2,719	2,846	3,625	5,438	1,976
M45x4.5	70	1306	502.83	2,466	2,263	2,828	3,168	3,394	3,553	4,526	6,788	2,466
M48x5	75	1473	567.19	2,968	2,723	3,403	3,812	4,084	4,274	5,445	8,168	2,968
M52x5	80	1758	676.80	3,836	3,519	4,399	4,927	5,279	5,525	7,039	10,558	3,836
M56x5.5	85	2030	781.59	4,771	4,377	5,471	6,128	6,565	6,872	8,754	13,131	4,771
M60x5.5	90	2362	909.42	5,948	5,456	6,821	7,639	8,185	8,567	10,913	16,369	5,948
M64x6	95	2676	1,030.29	7,187	6,594	8,242	9,231	9,891	10,352	13,188	19,782	7,187
M68x6	100	3055	1,176.33	8,719	7,999	9,999	11,199	11,999	12,559	15,998	23,997	8,719
M72x6	105	3460	1,332.05	10,454	9,591	11,988	13,427	14,386	15,058	19,182	28,772	10,454
M76x6	110	3889	1,497.45	12,405	11,381	14,226	15,933	17,071	17,868	22,761	34,142	12,405
M80x6	115	4344	1,672.52	14,584	13,380	16,725	18,732	20,070	21,007	26,760	40,140	14,584
M90x6	130	5591	2,152.53	21,116	19,373	24,216	27,122	29,059	30,415	38,745	58,118	21,116
M100x6	145	6995	2,693.01	29,354	26,930	33,663	37,702	40,395	42,280	53,860	80,790	29,354
M110x6	155	8556	3,293.97	39,495	36,234	45,292	50,727	54,351	56,887	72,467	108,701	39,495
M125x6	180	11192	4,308.80	58,707	53,860	67,325	75,404	80,790	84,560	107,720	161,580	58,707

TORQUE GUIDE FOR MATERIAL STANDARD 1.7709						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			550									
BOLT LOAD BASED ON			80	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) K=.300
												0.109
M20x2.5	30	245	107.72	235	215	269	302	323	338	431	646	235
M22x2.5	32	303	133.50	320	294	367	411	441	461	587	881	320
M24x3	36	353	155.11	406	372	465	521	558	584	745	1,117	406
M27x3	41	459	202.15	595	546	682	764	819	857	1,092	1,637	595
M30x3.5	46	561	246.67	807	740	925	1,036	1,110	1,162	1,480	2,220	807
M33x3.5	50	694	305.18	1,098	1,007	1,259	1,410	1,511	1,581	2,014	3,021	1,098
M36x4	55	817	359.38	1,410	1,294	1,617	1,811	1,941	2,031	2,588	3,881	1,410
M39x4	60	976	429.35	1,825	1,674	2,093	2,344	2,512	2,629	3,349	5,023	1,825
M42x4.5	65	1121	493.22	2,258	2,072	2,589	2,900	3,107	3,252	4,143	6,215	2,258
M45x4.5	70	1306	574.67	2,819	2,586	3,233	3,620	3,879	4,060	5,172	7,758	2,819
M48x5	75	1473	648.22	3,391	3,111	3,889	4,356	4,667	4,885	6,223	9,334	3,391
M52x5	80	1758	773.48	4,384	4,022	5,028	5,631	6,033	6,315	8,044	12,066	4,384
M56x5.5	85	2030	893.25	5,452	5,002	6,253	7,003	7,503	7,853	10,004	15,007	5,452
M60x5.5	90	2362	1,039.33	6,797	6,236	7,795	8,730	9,354	9,791	12,472	18,708	6,797
M64x6	95	2676	1,177.48	8,214	7,536	9,420	10,550	11,304	11,831	15,072	22,608	8,214
M68x6	100	3055	1,344.38	9,965	9,142	11,427	12,799	13,713	14,353	18,284	27,425	9,965
M72x6	105	3460	1,522.35	11,947	10,961	13,701	15,345	16,441	17,209	21,922	32,883	11,947
M76x6	110	3889	1,711.37	14,177	13,006	16,258	18,209	19,510	20,420	26,013	39,019	14,177
M80x6	115	4344	1,911.45	16,668	15,292	19,114	21,408	22,937	24,008	30,583	45,875	16,668
M90x6	130	5591	2,460.03	24,133	22,140	27,675	30,996	33,210	34,760	44,281	66,421	24,133
M100x6	145	6995	3,077.73	33,547	30,777	38,472	43,088	46,166	48,320	61,555	92,332	33,547
M110x6	155	8556	3,764.54	45,137	41,410	51,762	57,974	62,115	65,014	82,820	124,230	45,137
M125x6	180	11192	4,924.35	67,094	61,554	76,943	86,176	92,331	96,640	123,109	184,663	67,094

TORQUE GUIDE FOR MATERIAL STANDARD 1.7709						REQUIRED TORQUE (N-m)						
MINIMUM YIELD (Mpa)			550									
BOLT LOAD BASED ON			90	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) K=.300 0.109
M20x2.5	30	245	121.18	264	242	303	339	364	381	485	727	264
M22x2.5	32	303	150.19	360	330	413	463	496	519	661	991	360
M24x3	36	353	174.50	456	419	523	586	628	658	838	1,256	456
M27x3	41	459	227.42	669	614	768	860	921	964	1,228	1,842	669
M30x3.5	46	561	277.51	907	833	1,041	1,166	1,249	1,307	1,665	2,498	907
M33x3.5	50	694	343.33	1,235	1,133	1,416	1,586	1,699	1,779	2,266	3,399	1,235
M36x4	55	817	404.30	1,586	1,455	1,819	2,038	2,183	2,285	2,911	4,366	1,586
M39x4	60	976	483.02	2,053	1,884	2,355	2,637	2,826	2,958	3,768	5,651	2,053
M42x4.5	65	1121	554.88	2,540	2,330	2,913	3,263	3,496	3,659	4,661	6,991	2,540
M45x4.5	70	1306	646.50	3,171	2,909	3,637	4,073	4,364	4,568	5,819	8,728	3,171
M48x5	75	1473	729.24	3,815	3,500	4,375	4,901	5,251	5,496	7,001	10,501	3,815
M52x5	80	1758	870.17	4,932	4,525	5,656	6,335	6,787	7,104	9,050	13,575	4,932
M56x5.5	85	2030	1,004.90	6,134	5,627	7,034	7,878	8,441	8,835	11,255	16,882	6,134
M60x5.5	90	2362	1,169.25	7,647	7,015	8,769	9,822	10,523	11,014	14,031	21,046	7,647
M64x6	95	2676	1,324.66	9,241	8,478	10,597	11,869	12,717	13,310	16,956	25,434	9,241
M68x6	100	3055	1,512.43	11,210	10,285	12,856	14,398	15,427	16,147	20,569	30,854	11,210
M72x6	105	3460	1,712.64	13,441	12,331	15,414	17,263	18,497	19,360	24,662	36,993	13,441
M76x6	110	3889	1,925.29	15,949	14,632	18,290	20,485	21,948	22,973	29,264	43,897	15,949
M80x6	115	4344	2,150.38	18,751	17,203	21,504	24,084	25,805	27,009	34,406	51,609	18,751
M90x6	130	5591	2,767.53	27,149	24,908	31,135	34,871	37,362	39,105	49,816	74,723	27,149
M100x6	145	6995	3,462.44	37,741	34,624	43,281	48,474	51,937	54,360	69,249	103,873	37,741
M110x6	155	8556	4,235.10	50,779	46,586	58,233	65,221	69,879	73,140	93,172	139,758	50,779
M125x6	180	11192	5,539.89	75,481	69,249	86,561	96,948	103,873	108,720	138,497	207,746	75,481

TORQUE GUIDE FOR MATERIAL STANDARD 1.7709						REQUIRED TORQUE (N-m)						
MINIMUM YIELD (Mpa)			550									
BOLT LOAD BASED ON			99	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) K=.300 0.109
M20x2.5	30	245	133.30	291	267	333	373	400	419	533	800	291
M22x2.5	32	303	165.21	396	363	454	509	545	571	727	1,090	396
M24x3	36	353	191.95	502	461	576	645	691	723	921	1,382	502
M27x3	41	459	250.16	736	675	844	946	1,013	1,060	1,351	2,026	736
M30x3.5	46	561	305.26	998	916	1,145	1,282	1,374	1,438	1,832	2,747	998
M33x3.5	50	694	377.66	1,358	1,246	1,558	1,745	1,869	1,957	2,493	3,739	1,358
M36x4	55	817	444.73	1,745	1,601	2,001	2,241	2,402	2,514	3,202	4,803	1,745
M39x4	60	976	531.32	2,259	2,072	2,590	2,901	3,108	3,253	4,144	6,216	2,259
M42x4.5	65	1121	610.37	2,794	2,564	3,204	3,589	3,845	4,025	5,127	7,691	2,794
M45x4.5	70	1306	711.15	3,488	3,200	4,000	4,480	4,800	5,024	6,400	9,601	3,488
M48x5	75	1473	802.17	4,197	3,850	4,813	5,391	5,776	6,045	7,701	11,551	4,197
M52x5	80	1758	957.18	5,425	4,977	6,222	6,968	7,466	7,814	9,955	14,932	5,425
M56x5.5	85	2030	1,105.39	6,747	6,190	7,738	8,666	9,285	9,719	12,380	18,571	6,747
M60x5.5	90	2362	1,286.17	8,412	7,717	9,646	10,804	11,576	12,116	15,434	23,151	8,412
M64x6	95	2676	1,457.13	10,165	9,326	11,657	13,056	13,988	14,641	18,651	27,977	10,165
M68x6	100	3055	1,663.67	12,331	11,313	14,141	15,838	16,969	17,761	22,626	33,939	12,331
M72x6	105	3460	1,883.90	14,785	13,564	16,955	18,990	20,346	21,296	27,128	40,692	14,785
M76x6	110	3889	2,117.82	17,544	16,095	20,119	22,534	24,143	25,270	32,191	48,286	17,544
M80x6	115	4344	2,365.42	20,626	18,923	23,654	26,493	28,385	29,710	37,847	56,770	20,626
M90x6	130	5591	3,044.29	29,864	27,399	34,248	38,358	41,098	43,016	54,797	82,196	29,864
M100x6	145	6995	3,808.69	41,515	38,087	47,609	53,322	57,130	59,796	76,174	114,261	41,515
M110x6	155	8556	4,658.61	55,857	51,245	64,056	71,743	76,867	80,454	102,490	153,734	55,857
M125x6	180	11192	6,093.88	83,029	76,173	95,217	106,643	114,260	119,592	152,347	228,520	83,029

BOLT LOAD (METRIC) (MATERIAL STANDARD 1.7711)

40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR MATERIAL STANDARD 1.7711

MINIMUM YIELD (Mpa) 700

BOLT LOAD BASED ON 40 PERCENT YIELD

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHIN OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	68.55	149	137	171	192	206	215	274	411	149
M22x2.5	32	303	84.96	204	187	234	262	280	293	374	561	204
M24x3	36	353	98.71	258	237	296	332	355	372	474	711	258
M27x3	41	459	128.64	379	347	434	486	521	545	695	1,042	379
M30x3.5	46	561	156.97	513	471	589	659	706	739	942	1,413	513
M33x3.5	50	694	194.20	699	641	801	897	961	1,006	1,282	1,923	699
M36x4	55	817	228.69	897	823	1,029	1,153	1,235	1,293	1,647	2,470	897
M39x4	60	976	273.22	1,161	1,066	1,332	1,492	1,598	1,673	2,131	3,197	1,161
M42x4.5	65	1121	313.87	1,437	1,318	1,648	1,846	1,977	2,070	2,637	3,955	1,437
M45x4.5	70	1306	365.70	1,794	1,646	2,057	2,304	2,468	2,584	3,291	4,937	1,794
M48x5	75	1473	412.50	2,158	1,980	2,475	2,772	2,970	3,109	3,960	5,940	2,158
M52x5	80	1758	492.21	2,790	2,560	3,199	3,583	3,839	4,018	5,119	7,679	2,790
M56x5.5	85	2030	568.43	3,470	3,183	3,979	4,456	4,775	4,998	6,366	9,550	3,470
M60x5.5	90	2362	661.39	4,326	3,968	4,960	5,556	5,953	6,230	7,937	11,905	4,326
M64x6	95	2676	749.30	5,227	4,796	5,994	6,714	7,193	7,529	9,591	14,387	5,227
M68x6	100	3055	855.52	6,341	5,818	7,272	8,145	8,726	9,133	11,635	17,453	6,341
M72x6	105	3460	968.77	7,603	6,975	8,719	9,765	10,463	10,951	13,950	20,925	7,603
M76x6	110	3889	1,089.05	9,022	8,277	10,346	11,588	12,415	12,995	16,554	24,830	9,022
M80x6	115	4344	1,216.38	10,607	9,731	12,164	13,623	14,597	15,278	19,462	29,193	10,607
M90x6	130	5591	1,565.47	15,357	14,089	17,612	19,725	21,134	22,120	28,179	42,268	15,357
M100x6	145	6995	1,958.55	21,348	19,586	24,482	27,420	29,378	30,749	39,171	58,757	21,348
M110x6	155	8556	2,395.61	28,723	26,352	32,940	36,892	39,528	41,372	52,704	79,055	28,723
M125x6	180	11192	3,133.67	42,696	39,171	48,964	54,839	58,756	61,498	78,342	117,513	42,696

TORQUE GUIDE FOR MATERIAL STANDARD 1.7711						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			700									
BOLT LOAD BASED ON			50	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHIN OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	85.68	187	171	214	240	257	269	343	514	187
M22x2.5	32	303	106.20	255	234	292	327	350	367	467	701	255
M24x3	36	353	123.38	323	296	370	415	444	465	592	888	323
M27x3	41	459	160.80	473	434	543	608	651	682	868	1,302	473
M30x3.5	46	561	196.22	642	589	736	824	883	924	1,177	1,766	642
M33x3.5	50	694	242.76	873	801	1,001	1,122	1,202	1,258	1,602	2,403	873
M36x4	55	817	285.87	1,122	1,029	1,286	1,441	1,544	1,616	2,058	3,087	1,122
M39x4	60	976	341.53	1,452	1,332	1,665	1,865	1,998	2,091	2,664	3,996	1,452
M42x4.5	65	1121	392.34	1,796	1,648	2,060	2,307	2,472	2,587	3,296	4,943	1,796
M45x4.5	70	1306	457.12	2,242	2,057	2,571	2,880	3,086	3,230	4,114	6,171	2,242
M48x5	75	1473	515.63	2,698	2,475	3,094	3,465	3,713	3,886	4,950	7,425	2,698
M52x5	80	1758	615.27	3,487	3,199	3,999	4,479	4,799	5,023	6,399	9,598	3,487
M56x5.5	85	2030	710.54	4,337	3,979	4,974	5,571	5,969	6,247	7,958	11,937	4,337
M60x5.5	90	2362	826.74	5,407	4,960	6,201	6,945	7,441	7,788	9,921	14,881	5,407
M64x6	95	2676	936.63	6,534	5,994	7,493	8,392	8,992	9,411	11,989	17,983	6,534
M68x6	100	3055	1,069.40	7,926	7,272	9,090	10,181	10,908	11,417	14,544	21,816	7,926
M72x6	105	3460	1,210.96	9,504	8,719	10,899	12,206	13,078	13,689	17,438	26,157	9,504
M76x6	110	3889	1,361.32	11,277	10,346	12,932	14,484	15,519	16,243	20,692	31,038	11,277
M80x6	115	4344	1,520.47	13,258	12,164	15,205	17,029	18,246	19,097	24,328	36,491	13,258
M90x6	130	5591	1,956.84	19,197	17,612	22,014	24,656	26,417	27,650	35,223	52,835	19,197
M100x6	145	6995	2,448.19	26,685	24,482	30,602	34,275	36,723	38,437	48,964	73,446	26,685
M110x6	155	8556	2,994.52	35,904	32,940	41,175	46,116	49,410	51,715	65,879	98,819	35,904
M125x6	180	11192	3,917.09	53,370	48,964	61,205	68,549	73,445	76,873	97,927	146,891	53,370

TORQUE GUIDE FOR MATERIAL STANDARD 1.7711						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			700									
BOLT LOAD BASED ON			60	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHIN OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	102.82	224	206	257	288	308	323	411	617	224
M22x2.5	32	303	127.43	306	280	350	392	421	440	561	841	306
M24x3	36	353	148.06	387	355	444	497	533	558	711	1,066	387
M27x3	41	459	192.96	568	521	651	729	781	818	1,042	1,563	568
M30x3.5	46	561	235.46	770	706	883	989	1,060	1,109	1,413	2,119	770
M33x3.5	50	694	291.31	1,048	961	1,202	1,346	1,442	1,509	1,923	2,884	1,048
M36x4	55	817	343.04	1,346	1,235	1,544	1,729	1,852	1,939	2,470	3,705	1,346
M39x4	60	976	409.84	1,742	1,598	1,998	2,238	2,398	2,509	3,197	4,795	1,742
M42x4.5	65	1121	470.81	2,155	1,977	2,472	2,768	2,966	3,104	3,955	5,932	2,155
M45x4.5	70	1306	548.55	2,691	2,468	3,086	3,456	3,703	3,875	4,937	7,405	2,691
M48x5	75	1473	618.75	3,237	2,970	3,713	4,158	4,455	4,663	5,940	8,910	3,237
M52x5	80	1758	738.32	4,185	3,839	4,799	5,375	5,759	6,028	7,679	11,518	4,185
M56x5.5	85	2030	852.65	5,205	4,775	5,969	6,685	7,162	7,496	9,550	14,324	5,205
M60x5.5	90	2362	992.09	6,488	5,953	7,441	8,334	8,929	9,345	11,905	17,858	6,488
M64x6	95	2676	1,123.96	7,841	7,193	8,992	10,071	10,790	11,294	14,387	21,580	7,841
M68x6	100	3055	1,283.27	9,512	8,726	10,908	12,217	13,089	13,700	17,453	26,179	9,512
M72x6	105	3460	1,453.15	11,404	10,463	13,078	14,648	15,694	16,426	20,925	31,388	11,404
M76x6	110	3889	1,633.58	13,533	12,415	15,519	17,381	18,623	19,492	24,830	37,246	13,533
M80x6	115	4344	1,824.56	15,910	14,597	18,246	20,435	21,895	22,917	29,193	43,790	15,910
M90x6	130	5591	2,348.21	23,036	21,134	26,417	29,587	31,701	33,180	42,268	63,402	23,036
M100x6	145	6995	2,937.83	32,022	29,378	36,723	41,130	44,067	46,124	58,757	88,135	32,022
M110x6	155	8556	3,593.42	43,085	39,528	49,410	55,339	59,291	62,058	79,055	118,583	43,085
M125x6	180	11192	4,700.51	64,044	58,756	73,445	82,259	88,135	92,248	117,513	176,269	64,044

TORQUE GUIDE FOR MATERIAL STANDARD 1.7711						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			700									
BOLT LOAD BASED ON			70	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHIN OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	119.96	262	240	300	336	360	377	480	720	262
M22x2.5	32	303	148.67	357	327	409	458	491	514	654	981	357
M24x3	36	353	172.74	452	415	518	580	622	651	829	1,244	452
M27x3	41	459	225.12	663	608	760	851	912	954	1,216	1,823	663
M30x3.5	46	561	274.70	898	824	1,030	1,154	1,236	1,294	1,648	2,472	898
M33x3.5	50	694	339.86	1,222	1,122	1,402	1,570	1,682	1,761	2,243	3,365	1,222
M36x4	55	817	400.21	1,570	1,441	1,801	2,017	2,161	2,262	2,882	4,322	1,570
M39x4	60	976	478.14	2,033	1,865	2,331	2,611	2,797	2,928	3,729	5,594	2,033
M42x4.5	65	1121	549.27	2,515	2,307	2,884	3,230	3,460	3,622	4,614	6,921	2,515
M45x4.5	70	1306	639.97	3,139	2,880	3,600	4,032	4,320	4,521	5,760	8,640	3,139
M48x5	75	1473	721.88	3,777	3,465	4,331	4,851	5,198	5,440	6,930	10,395	3,777
M52x5	80	1758	861.38	4,882	4,479	5,599	6,271	6,719	7,032	8,958	13,437	4,882
M56x5.5	85	2030	994.75	6,072	5,571	6,963	7,799	8,356	8,746	11,141	16,712	6,072
M60x5.5	90	2362	1,157.44	7,570	6,945	8,681	9,722	10,417	10,903	13,889	20,834	7,570
M64x6	95	2676	1,311.28	9,148	8,392	10,490	11,749	12,588	13,176	16,784	25,177	9,148
M68x6	100	3055	1,497.15	11,097	10,181	12,726	14,253	15,271	15,984	20,361	30,542	11,097
M72x6	105	3460	1,695.34	13,305	12,206	15,258	17,089	18,310	19,164	24,413	36,619	13,305
M76x6	110	3889	1,905.84	15,788	14,484	18,105	20,278	21,727	22,741	28,969	43,453	15,788
M80x6	115	4344	2,128.66	18,562	17,029	21,287	23,841	25,544	26,736	34,059	51,088	18,562
M90x6	130	5591	2,739.58	26,875	24,656	30,820	34,519	36,984	38,710	49,312	73,969	26,875
M100x6	145	6995	3,427.47	37,359	34,275	42,843	47,985	51,412	53,811	68,549	102,824	37,359
M110x6	155	8556	4,192.33	50,266	46,116	57,644	64,562	69,173	72,401	92,231	138,347	50,266
M125x6	180	11192	5,483.93	74,719	68,549	85,686	95,969	102,824	107,622	137,098	205,647	74,719

TORQUE GUIDE FOR MATERIAL STANDARD 1.7711						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			700									
BOLT LOAD BASED ON			80	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHIN OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	137.09	299	274	343	384	411	430	548	823	299
M22x2.5	32	303	169.91	407	374	467	523	561	587	748	1,121	407
M24x3	36	353	197.41	516	474	592	663	711	744	948	1,421	516
M27x3	41	459	257.28	757	695	868	973	1,042	1,091	1,389	2,084	757
M30x3.5	46	561	313.95	1,027	942	1,177	1,319	1,413	1,479	1,884	2,826	1,027
M33x3.5	50	694	388.41	1,397	1,282	1,602	1,794	1,923	2,012	2,563	3,845	1,397
M36x4	55	817	457.39	1,795	1,647	2,058	2,305	2,470	2,585	3,293	4,940	1,795
M39x4	60	976	546.45	2,323	2,131	2,664	2,984	3,197	3,346	4,262	6,393	2,323
M42x4.5	65	1121	627.74	2,874	2,637	3,296	3,691	3,955	4,139	5,273	7,910	2,874
M45x4.5	70	1306	731.40	3,587	3,291	4,114	4,608	4,937	5,167	6,583	9,874	3,587
M48x5	75	1473	825.00	4,316	3,960	4,950	5,544	5,940	6,217	7,920	11,880	4,316
M52x5	80	1758	984.43	5,580	5,119	6,399	7,167	7,679	8,037	10,238	15,357	5,580
M56x5.5	85	2030	1,136.86	6,939	6,366	7,958	8,913	9,550	9,995	12,733	19,099	6,939
M60x5.5	90	2362	1,322.79	8,651	7,937	9,921	11,111	11,905	12,461	15,873	23,810	8,651
M64x6	95	2676	1,498.61	10,454	9,591	11,989	13,428	14,387	15,058	19,182	28,773	10,454
M68x6	100	3055	1,711.03	12,682	11,635	14,544	16,289	17,453	18,267	23,270	34,905	12,682
M72x6	105	3460	1,937.53	15,206	13,950	17,438	19,530	20,925	21,902	27,900	41,851	15,206
M76x6	110	3889	2,178.10	18,043	16,554	20,692	23,175	24,830	25,989	33,107	49,661	18,043
M80x6	115	4344	2,432.75	21,214	19,462	24,328	27,247	29,193	30,555	38,924	58,386	21,214
M90x6	130	5591	3,130.95	30,715	28,179	35,223	39,450	42,268	44,240	56,357	84,536	30,715
M100x6	145	6995	3,917.11	42,696	39,171	48,964	54,839	58,757	61,499	78,342	117,513	42,696
M110x6	155	8556	4,791.23	57,447	52,704	65,879	73,785	79,055	82,745	105,407	158,111	57,447
M125x6	180	11192	6,267.35	85,393	78,342	97,927	109,679	117,513	122,997	156,684	235,026	85,393

TORQUE GUIDE FOR MATERIAL STANDARD 1.7711						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			700									
BOLT LOAD BASED ON			90	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHIN OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	154.23	336	308	386	432	463	484	617	925	336
M22x2.5	32	303	191.15	458	421	526	589	631	660	841	1,262	458
M24x3	36	353	222.09	581	533	666	746	800	837	1,066	1,599	581
M27x3	41	459	289.44	852	781	977	1,094	1,172	1,227	1,563	2,344	852
M30x3.5	46	561	353.19	1,155	1,060	1,324	1,483	1,589	1,664	2,119	3,179	1,155
M33x3.5	50	694	436.96	1,572	1,442	1,802	2,019	2,163	2,264	2,884	4,326	1,572
M36x4	55	817	514.56	2,019	1,852	2,316	2,593	2,779	2,908	3,705	5,557	2,019
M39x4	60	976	614.75	2,613	2,398	2,997	3,357	3,596	3,764	4,795	7,193	2,613
M42x4.5	65	1121	706.21	3,233	2,966	3,708	4,153	4,449	4,657	5,932	8,898	3,233
M45x4.5	70	1306	822.82	4,036	3,703	4,628	5,184	5,554	5,813	7,405	11,108	4,036
M48x5	75	1473	928.13	4,856	4,455	5,569	6,237	6,683	6,994	8,910	13,365	4,856
M52x5	80	1758	1,107.48	6,277	5,759	7,199	8,062	8,638	9,041	11,518	17,277	6,277
M56x5.5	85	2030	1,278.97	7,807	7,162	8,953	10,027	10,743	11,245	14,324	21,487	7,807
M60x5.5	90	2362	1,488.13	9,732	8,929	11,161	12,500	13,393	14,018	17,858	26,786	9,732
M64x6	95	2676	1,685.93	11,761	10,790	13,487	15,106	16,185	16,940	21,580	32,370	11,761
M68x6	100	3055	1,924.91	14,267	13,089	16,362	18,325	19,634	20,550	26,179	39,268	14,267
M72x6	105	3460	2,179.72	17,106	15,694	19,618	21,972	23,541	24,640	31,388	47,082	17,106
M76x6	110	3889	2,450.37	20,299	18,623	23,278	26,072	27,934	29,238	37,246	55,868	20,299
M80x6	115	4344	2,736.85	23,865	21,895	27,368	30,653	32,842	34,375	43,790	65,684	23,865
M90x6	130	5591	3,522.31	34,554	31,701	39,626	44,381	47,551	49,770	63,402	95,102	34,554
M100x6	145	6995	4,406.74	48,034	44,067	55,084	61,694	66,101	69,186	88,135	132,202	48,034
M110x6	155	8556	5,390.13	64,628	59,291	74,114	83,008	88,937	93,088	118,583	177,874	64,628
M125x6	180	11192	7,050.77	96,067	88,135	110,168	123,388	132,202	138,371	176,269	264,404	96,067

TORQUE GUIDE FOR MATERIAL STANDARD 1.7711						**REQUIRED TORQUE** (N-m)						
MINIMUM YIELD (Mpa)			700									
BOLT LOAD BASED ON			99	PERCENT YIELD								
BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLY DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHIN OIL K=.200	DRY STEEL K=.300	CUSTOM (INSERT K) 0.109
M20x2.5	30	245	169.65	370	339	424	475	509	533	679	1,018	370
M22x2.5	32	303	210.27	504	463	578	648	694	726	925	1,388	504
M24x3	36	353	244.30	639	586	733	821	879	921	1,173	1,759	639
M27x3	41	459	318.38	937	860	1,075	1,203	1,289	1,350	1,719	2,579	937
M30x3.5	46	561	388.51	1,270	1,166	1,457	1,632	1,748	1,830	2,331	3,497	1,270
M33x3.5	50	694	480.66	1,729	1,586	1,983	2,221	2,379	2,490	3,172	4,758	1,729
M36x4	55	817	566.02	2,221	2,038	2,547	2,853	3,056	3,199	4,075	6,113	2,221
M39x4	60	976	676.23	2,875	2,637	3,297	3,692	3,956	4,141	5,275	7,912	2,875
M42x4.5	65	1121	776.83	3,556	3,263	4,078	4,568	4,894	5,122	6,525	9,788	3,556
M45x4.5	70	1306	905.10	4,440	4,073	5,091	5,702	6,109	6,395	8,146	12,219	4,440
M48x5	75	1473	1,020.94	5,342	4,901	6,126	6,861	7,351	7,694	9,801	14,702	5,342
M52x5	80	1758	1,218.23	6,905	6,335	7,919	8,869	9,502	9,946	12,670	19,004	6,905
M56x5.5	85	2030	1,406.86	8,588	7,878	9,848	11,030	11,818	12,369	15,757	23,635	8,588
M60x5.5	90	2362	1,636.95	10,706	9,822	12,277	13,750	14,733	15,420	19,643	29,465	10,706
M64x6	95	2676	1,854.53	12,937	11,869	14,836	16,617	17,803	18,634	23,738	35,607	12,937
M68x6	100	3055	2,117.40	15,694	14,398	17,998	20,158	21,598	22,605	28,797	43,195	15,694
M72x6	105	3460	2,397.70	18,817	17,263	21,579	24,169	25,895	27,104	34,527	51,790	18,817
M76x6	110	3889	2,695.40	22,329	20,485	25,606	28,679	30,728	32,162	40,970	61,455	22,329
M80x6	115	4344	3,010.53	26,252	24,084	30,105	33,718	36,126	37,812	48,168	72,253	26,252
M90x6	130	5591	3,874.55	38,009	34,871	43,589	48,819	52,306	54,747	69,742	104,613	38,009
M100x6	145	6995	4,847.42	52,837	48,474	60,593	67,864	72,711	76,104	96,948	145,423	52,837
M110x6	155	8556	5,929.15	71,090	65,221	81,526	91,309	97,831	102,396	130,441	195,662	71,090
M125x6	180	11192	7,755.84	105,673	96,948	121,185	135,727	145,422	152,208	193,896	290,844	105,673

BOLT LOAD (METRIC) SOCKET HEAD CAP SCREWS (MATERIAL GR 4.6)

40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

TORQUE GUIDE FOR ISO **R898** GRADE **4.6**

MINIMUM YIELD (Mpa) 240

BOLT LOAD BASED ON 40 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	23.50	51	47	59	66	71	74	94	207	51
M22x2.5	32	303	29.13	70	64	80	90	96	101	128	282	70
M24x3	36	353	33.84	89	81	102	114	122	128	162	357	89
M27x3	41	459	44.11	130	119	149	167	179	187	238	524	130
M30x3.5	46	561	53.82	176	161	202	226	242	253	323	710	176
M33x3.5	50	694	66.58	240	220	275	308	330	345	439	967	240
M36x4	55	817	78.41	308	282	353	395	423	443	565	1,242	308
M39x4	60	976	93.68	398	365	457	511	548	574	731	1,607	398
M42x4.5	65	1121	107.61	493	452	565	633	678	710	904	1,989	493
M45x4.5	70	1306	125.38	615	564	705	790	846	886	1,128	2,483	615
M48x5	75	1473	141.43	740	679	849	950	1,018	1,066	1,358	2,987	740
M52x5	80	1758	168.76	957	878	1,097	1,229	1,316	1,378	1,755	3,861	957
M56x5.5	85	2030	194.89	1,190	1,091	1,364	1,528	1,637	1,713	2,183	4,802	1,190
M60x5.5	90	2362	226.76	1,483	1,361	1,701	1,905	2,041	2,136	2,721	5,987	1,483
M64x6	95	2676	256.90	1,792	1,644	2,055	2,302	2,466	2,581	3,288	7,234	1,792
M68x6	100	3055	293.32	2,174	1,995	2,493	2,792	2,992	3,131	3,989	8,776	2,174
M72x6	105	3460	332.15	2,607	2,391	2,989	3,348	3,587	3,755	4,783	10,522	2,607
M76x6	110	3889	373.39	3,093	2,838	3,547	3,973	4,257	4,455	5,676	12,486	3,093
M80x6	115	4344	417.04	3,637	3,336	4,170	4,671	5,005	5,238	6,673	14,680	3,637
M90x6	130	5591	536.73	5,265	4,831	6,038	6,763	7,246	7,584	9,661	21,255	5,265
M100x6	145	6995	671.50	7,319	6,715	8,394	9,401	10,073	10,543	13,430	29,546	7,319
M110x6	155	8556	821.35	9,848	9,035	11,294	12,649	13,552	14,185	18,070	39,754	9,848
M125x6	180	11192	1,074.40	14,639	13,430	16,788	18,802	20,145	21,085	26,860	59,092	14,639

TORQUE GUIDE FOR ISO **R898** GRADE **4.6**

MINIMUM YIELD (Mpa) 240

BOLT LOAD BASED ON 50 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	29.38	64	59	73	82	88	92	118	259	64
M22x2.5	32	303	36.41	87	80	100	112	120	126	160	352	87
M24x3	36	353	42.30	111	102	127	142	152	159	203	447	111
M27x3	41	459	55.13	162	149	186	208	223	234	298	655	162
M30x3.5	46	561	67.27	220	202	252	283	303	317	404	888	220
M33x3.5	50	694	83.23	299	275	343	385	412	431	549	1,209	299
M36x4	55	817	98.01	385	353	441	494	529	554	706	1,553	385
M39x4	60	976	117.10	498	457	571	639	685	717	913	2,009	498
M42x4.5	65	1121	134.52	616	565	706	791	847	887	1,130	2,486	616
M45x4.5	70	1306	156.73	769	705	882	987	1,058	1,107	1,411	3,103	769
M48x5	75	1473	176.79	925	849	1,061	1,188	1,273	1,332	1,697	3,734	925
M52x5	80	1758	210.95	1,196	1,097	1,371	1,536	1,645	1,722	2,194	4,827	1,196
M56x5.5	85	2030	243.61	1,487	1,364	1,705	1,910	2,046	2,142	2,728	6,003	1,487
M60x5.5	90	2362	283.45	1,854	1,701	2,126	2,381	2,551	2,670	3,401	7,483	1,854
M64x6	95	2676	321.13	2,240	2,055	2,569	2,877	3,083	3,227	4,110	9,043	2,240
M68x6	100	3055	366.65	2,718	2,493	3,117	3,491	3,740	3,914	4,986	10,970	2,718
M72x6	105	3460	415.19	3,258	2,989	3,737	4,185	4,484	4,693	5,979	13,153	3,258
M76x6	110	3889	466.74	3,866	3,547	4,434	4,966	5,321	5,569	7,094	15,608	3,866
M80x6	115	4344	521.30	4,546	4,170	5,213	5,839	6,256	6,548	8,341	18,350	4,546
M90x6	130	5591	670.92	6,582	6,038	7,548	8,454	9,057	9,480	12,077	26,568	6,582
M100x6	145	6995	839.38	9,149	8,394	10,492	11,751	12,591	13,178	16,788	36,933	9,149
M110x6	155	8556	1,026.69	12,310	11,294	14,117	15,811	16,940	17,731	22,587	49,692	12,310
M125x6	180	11192	1,343.00	18,298	16,788	20,984	23,503	25,181	26,356	33,575	73,865	18,298

TORQUE GUIDE FOR ISO **R898** GRADE **4.6**

MINIMUM YIELD (Mpa) 240

BOLT LOAD BASED ON 60 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	35.25	77	71	88	99	106	111	141	310	77
M22x2.5	32	303	43.69	105	96	120	135	144	151	192	423	105
M24x3	36	353	50.76	133	122	152	171	183	191	244	536	133
M27x3	41	459	66.16	195	179	223	250	268	280	357	786	195
M30x3.5	46	561	80.73	264	242	303	339	363	380	484	1,066	264
M33x3.5	50	694	99.88	359	330	412	461	494	517	659	1,450	359
M36x4	55	817	117.61	462	423	529	593	635	665	847	1,863	462
M39x4	60	976	140.51	597	548	685	767	822	860	1,096	2,411	597
M42x4.5	65	1121	161.42	739	678	847	949	1,017	1,064	1,356	2,983	739
M45x4.5	70	1306	188.07	922	846	1,058	1,185	1,269	1,329	1,693	3,724	922
M48x5	75	1473	212.14	1,110	1,018	1,273	1,426	1,527	1,599	2,037	4,480	1,110
M52x5	80	1758	253.14	1,435	1,316	1,645	1,843	1,974	2,067	2,633	5,792	1,435
M56x5.5	85	2030	292.34	1,784	1,637	2,046	2,292	2,456	2,570	3,274	7,203	1,784
M60x5.5	90	2362	340.15	2,225	2,041	2,551	2,857	3,061	3,204	4,082	8,980	2,225
M64x6	95	2676	385.36	2,688	2,466	3,083	3,453	3,699	3,872	4,933	10,852	2,688
M68x6	100	3055	439.98	3,261	2,992	3,740	4,189	4,488	4,697	5,984	13,164	3,261
M72x6	105	3460	498.22	3,910	3,587	4,484	5,022	5,381	5,632	7,174	15,784	3,910
M76x6	110	3889	560.08	4,640	4,257	5,321	5,959	6,385	6,683	8,513	18,729	4,640
M80x6	115	4344	625.56	5,455	5,005	6,256	7,006	7,507	7,857	10,009	22,020	5,455
M90x6	130	5591	805.10	7,898	7,246	9,057	10,144	10,869	11,376	14,492	31,882	7,898
M100x6	145	6995	1,007.26	10,979	10,073	12,591	14,102	15,109	15,814	20,145	44,319	10,979
M110x6	155	8556	1,232.03	14,772	13,552	16,940	18,973	20,329	21,277	27,105	59,630	14,772
M125x6	180	11192	1,611.60	21,958	20,145	25,181	28,203	30,218	31,628	40,290	88,638	21,958

TORQUE GUIDE FOR ISO **R898** GRADE **4.6**

MINIMUM YIELD (Mpa) 240

BOLT LOAD BASED ON 70 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)^2	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	41.13	90	82	103	115	123	129	165	362	90
M22x2.5	32	303	50.97	122	112	140	157	168	176	224	493	122
M24x3	36	353	59.22	155	142	178	199	213	223	284	625	155
M27x3	41	459	77.18	227	208	260	292	313	327	417	917	227
M30x3.5	46	561	94.18	308	283	353	396	424	444	565	1,243	308
M33x3.5	50	694	116.52	419	385	481	538	577	604	769	1,692	419
M36x4	55	817	137.22	538	494	617	692	741	776	988	2,174	538
M39x4	60	976	163.93	697	639	799	895	959	1,004	1,279	2,813	697
M42x4.5	65	1121	188.32	862	791	989	1,107	1,186	1,242	1,582	3,480	862
M45x4.5	70	1306	219.42	1,076	987	1,234	1,382	1,481	1,550	1,975	4,344	1,076
M48x5	75	1473	247.50	1,295	1,188	1,485	1,663	1,782	1,865	2,376	5,227	1,295
M52x5	80	1758	295.33	1,674	1,536	1,920	2,150	2,304	2,411	3,071	6,757	1,674
M56x5.5	85	2030	341.06	2,082	1,910	2,387	2,674	2,865	2,999	3,820	8,404	2,082
M60x5.5	90	2362	396.84	2,595	2,381	2,976	3,333	3,572	3,738	4,762	10,476	2,595
M64x6	95	2676	449.58	3,136	2,877	3,597	4,028	4,316	4,517	5,755	12,660	3,136
M68x6	100	3055	513.31	3,805	3,491	4,363	4,887	5,236	5,480	6,981	15,358	3,805
M72x6	105	3460	581.26	4,562	4,185	5,231	5,859	6,278	6,571	8,370	18,414	4,562
M76x6	110	3889	653.43	5,413	4,966	6,208	6,953	7,449	7,797	9,932	21,851	5,413
M80x6	115	4344	729.83	6,364	5,839	7,298	8,174	8,758	9,167	11,677	25,690	6,364
M90x6	130	5591	939.28	9,214	8,454	10,567	11,835	12,680	13,272	16,907	37,196	9,214
M100x6	145	6995	1,175.13	12,809	11,751	14,689	16,452	17,627	18,450	23,503	51,706	12,809
M110x6	155	8556	1,437.37	17,234	15,811	19,764	22,135	23,717	24,823	31,622	69,569	17,234
M125x6	180	11192	1,880.20	25,618	23,503	29,378	32,904	35,254	36,899	47,005	103,411	25,618

TORQUE GUIDE FOR ISO **R898** GRADE **4.6**

MINIMUM YIELD (Mpa) 240

BOLT LOAD BASED ON 80 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	47.00	102	94	118	132	141	148	188	414	102
M22x2.5	32	303	58.26	140	128	160	179	192	201	256	564	140
M24x3	36	353	67.68	177	162	203	227	244	255	325	715	177
M27x3	41	459	88.21	260	238	298	333	357	374	476	1,048	260
M30x3.5	46	561	107.64	352	323	404	452	484	507	646	1,421	352
M33x3.5	50	694	133.17	479	439	549	615	659	690	879	1,934	479
M36x4	55	817	156.82	615	565	706	790	847	886	1,129	2,484	615
M39x4	60	976	187.35	796	731	913	1,023	1,096	1,147	1,461	3,215	796
M42x4.5	65	1121	215.23	985	904	1,130	1,266	1,356	1,419	1,808	3,977	985
M45x4.5	70	1306	250.76	1,230	1,128	1,411	1,580	1,693	1,772	2,257	4,965	1,230
M48x5	75	1473	282.86	1,480	1,358	1,697	1,901	2,037	2,132	2,715	5,974	1,480
M52x5	80	1758	337.52	1,913	1,755	2,194	2,457	2,633	2,756	3,510	7,722	1,913
M56x5.5	85	2030	389.78	2,379	2,183	2,728	3,056	3,274	3,427	4,366	9,604	2,379
M60x5.5	90	2362	453.53	2,966	2,721	3,401	3,810	4,082	4,272	5,442	11,973	2,966
M64x6	95	2676	513.81	3,584	3,288	4,110	4,604	4,933	5,163	6,577	14,469	3,584
M68x6	100	3055	586.64	4,348	3,989	4,986	5,585	5,984	6,263	7,978	17,552	4,348
M72x6	105	3460	664.30	5,213	4,783	5,979	6,696	7,174	7,509	9,566	21,045	5,213
M76x6	110	3889	746.78	6,186	5,676	7,094	7,946	8,513	8,911	11,351	24,972	6,186
M80x6	115	4344	834.09	7,273	6,673	8,341	9,342	10,009	10,476	13,345	29,360	7,273
M90x6	130	5591	1,073.47	10,531	9,661	12,077	13,526	14,492	15,168	19,322	42,509	10,531
M100x6	145	6995	1,343.01	14,639	13,430	16,788	18,802	20,145	21,085	26,860	59,092	14,639
M110x6	155	8556	1,642.71	19,696	18,070	22,587	25,298	27,105	28,370	36,140	79,507	19,696
M125x6	180	11192	2,148.81	29,277	26,860	33,575	37,604	40,290	42,170	53,720	118,184	29,277

TORQUE GUIDE FOR ISO **R898** GRADE **4.6**

MINIMUM YIELD (Mpa) 240

BOLT LOAD BASED ON 90 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	52.88	115	106	132	148	159	166	212	465	115
M22x2.5	32	303	65.54	157	144	180	202	216	226	288	634	157
M24x3	36	353	76.15	199	183	228	256	274	287	365	804	199
M27x3	41	459	99.24	292	268	335	375	402	421	536	1,179	292
M30x3.5	46	561	121.09	396	363	454	509	545	570	727	1,598	396
M33x3.5	50	694	149.81	539	494	618	692	742	776	989	2,175	539
M36x4	55	817	176.42	692	635	794	889	953	997	1,270	2,795	692
M39x4	60	976	210.77	896	822	1,028	1,151	1,233	1,291	1,644	3,617	896
M42x4.5	65	1121	242.13	1,108	1,017	1,271	1,424	1,525	1,597	2,034	4,475	1,108
M45x4.5	70	1306	282.11	1,384	1,269	1,587	1,777	1,904	1,993	2,539	5,586	1,384
M48x5	75	1473	318.22	1,665	1,527	1,909	2,138	2,291	2,398	3,055	6,721	1,665
M52x5	80	1758	379.71	2,152	1,974	2,468	2,764	2,962	3,100	3,949	8,688	2,152
M56x5.5	85	2030	438.50	2,677	2,456	3,070	3,438	3,683	3,855	4,911	10,805	2,677
M60x5.5	90	2362	510.22	3,337	3,061	3,827	4,286	4,592	4,806	6,123	13,470	3,337
M64x6	95	2676	578.03	4,032	3,699	4,624	5,179	5,549	5,808	7,399	16,277	4,032
M68x6	100	3055	659.97	4,892	4,488	5,610	6,283	6,732	7,046	8,976	19,746	4,892
M72x6	105	3460	747.33	5,865	5,381	6,726	7,533	8,071	8,448	10,762	23,676	5,865
M76x6	110	3889	840.13	6,960	6,385	7,981	8,939	9,577	10,024	12,770	28,094	6,960
M80x6	115	4344	938.35	8,182	7,507	9,383	10,509	11,260	11,786	15,014	33,030	8,182
M90x6	130	5591	1,207.65	11,847	10,869	13,586	15,216	16,303	17,064	21,738	47,823	11,847
M100x6	145	6995	1,510.88	16,469	15,109	18,886	21,152	22,663	23,721	30,218	66,479	16,469
M110x6	155	8556	1,848.05	22,158	20,329	25,411	28,460	30,493	31,916	40,657	89,445	22,158
M125x6	180	11192	2,417.41	32,937	30,218	37,772	42,305	45,326	47,442	60,435	132,957	32,937

TORQUE GUIDE FOR ISO **R898** GRADE **4.6**

MINIMUM YIELD (Mpa) 240

BOLT LOAD BASED ON 99 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	58.17	127	116	145	163	174	183	233	512	127
M22x2.5	32	303	72.09	173	159	198	222	238	249	317	698	173
M24x3	36	353	83.76	219	201	251	281	302	316	402	885	219
M27x3	41	459	109.16	321	295	368	413	442	463	589	1,297	321
M30x3.5	46	561	133.20	436	400	500	559	599	627	799	1,758	436
M33x3.5	50	694	164.80	593	544	680	761	816	854	1,088	2,393	593
M36x4	55	817	194.06	762	699	873	978	1,048	1,097	1,397	3,074	762
M39x4	60	976	231.85	986	904	1,130	1,266	1,356	1,420	1,808	3,979	986
M42x4.5	65	1121	266.34	1,219	1,119	1,398	1,566	1,678	1,756	2,237	4,922	1,219
M45x4.5	70	1306	310.32	1,522	1,396	1,746	1,955	2,095	2,192	2,793	6,144	1,522
M48x5	75	1473	350.04	1,831	1,680	2,100	2,352	2,520	2,638	3,360	7,393	1,831
M52x5	80	1758	417.68	2,367	2,172	2,715	3,041	3,258	3,410	4,344	9,557	2,367
M56x5.5	85	2030	482.35	2,944	2,701	3,376	3,782	4,052	4,241	5,402	11,885	2,944
M60x5.5	90	2362	561.24	3,671	3,367	4,209	4,714	5,051	5,287	6,735	14,817	3,671
M64x6	95	2676	635.84	4,436	4,069	5,087	5,697	6,104	6,389	8,139	17,905	4,436
M68x6	100	3055	725.97	5,381	4,937	6,171	6,911	7,405	7,750	9,873	21,721	5,381
M72x6	105	3460	822.07	6,452	5,919	7,399	8,286	8,878	9,293	11,838	26,043	6,452
M76x6	110	3889	924.14	7,656	7,023	8,779	9,833	10,535	11,027	14,047	30,903	7,656
M80x6	115	4344	1,032.18	9,001	8,257	10,322	11,560	12,386	12,964	16,515	36,333	9,001
M90x6	130	5591	1,328.42	13,032	11,956	14,945	16,738	17,934	18,771	23,911	52,605	13,032
M100x6	145	6995	1,661.97	18,115	16,620	20,775	23,268	24,930	26,093	33,239	73,127	18,115
M110x6	155	8556	2,032.85	24,374	22,361	27,952	31,306	33,542	35,107	44,723	98,390	24,374
M125x6	180	11192	2,659.15	36,231	33,239	41,549	46,535	49,859	52,186	66,479	146,253	36,231

BOLT LOAD (METRIC) SOCKET HEAD CAP SCREWS (MATERIAL GR 5.6)

40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

TORQUE GUIDE FOR ISO **R898** GRADE **5.6**

MINIMUM YIELD (Mpa) 300

BOLT LOAD BASED ON 40 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	LoaDISC TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	29.38	64	59	73	82	88	92	118	259	64
M22x2.5	32	303	36.41	87	80	100	112	120	126	160	352	87
M24x3	36	353	42.30	111	102	127	142	152	159	203	447	111
M27x3	41	459	55.13	162	149	186	208	223	234	298	655	162
M30x3.5	46	561	67.27	220	202	252	283	303	317	404	888	220
M33x3.5	50	694	83.23	299	275	343	385	412	431	549	1,209	299
M36x4	55	817	98.01	385	353	441	494	529	554	706	1,553	385
M39x4	60	976	117.10	498	457	571	639	685	717	913	2,009	498
M42x4.5	65	1121	134.52	616	565	706	791	847	887	1,130	2,486	616
M45x4.5	70	1306	156.73	769	705	882	987	1,058	1,107	1,411	3,103	769
M48x5	75	1473	176.79	925	849	1,061	1,188	1,273	1,332	1,697	3,734	925
M52x5	80	1758	210.95	1,196	1,097	1,371	1,536	1,645	1,722	2,194	4,827	1,196
M56x5.5	85	2030	243.61	1,487	1,364	1,705	1,910	2,046	2,142	2,728	6,003	1,487
M60x5.5	90	2362	283.45	1,854	1,701	2,126	2,381	2,551	2,670	3,401	7,483	1,854
M64x6	95	2676	321.13	2,240	2,055	2,569	2,877	3,083	3,227	4,110	9,043	2,240
M68x6	100	3055	366.65	2,718	2,493	3,117	3,491	3,740	3,914	4,986	10,970	2,718
M72x6	105	3460	415.19	3,258	2,989	3,737	4,185	4,484	4,693	5,979	13,153	3,258
M76x6	110	3889	466.74	3,866	3,547	4,434	4,966	5,321	5,569	7,094	15,608	3,866
M80x6	115	4344	521.30	4,546	4,170	5,213	5,839	6,256	6,548	8,341	18,350	4,546
M90x6	130	5591	670.92	6,582	6,038	7,548	8,454	9,057	9,480	12,077	26,568	6,582
M100x6	145	6995	839.38	9,149	8,394	10,492	11,751	12,591	13,178	16,788	36,933	9,149
M110x6	155	8556	1,026.69	12,310	11,294	14,117	15,811	16,940	17,731	22,587	49,692	12,310
M125x6	180	11192	1,343.00	18,298	16,788	20,984	23,503	25,181	26,356	33,575	73,865	18,298

TORQUE GUIDE FOR ISO **R898** GRADE **5.6**

MINIMUM YIELD (Mpa) 300

BOLT LOAD BASED ON 50 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	LoaDISC TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	36.72	80	73	92	103	110	115	147	323	80
M22x2.5	32	303	45.51	109	100	125	140	150	157	200	441	109
M24x3	36	353	52.88	138	127	159	178	190	199	254	558	138
M27x3	41	459	68.91	203	186	233	260	279	292	372	819	203
M30x3.5	46	561	84.09	275	252	315	353	378	396	505	1,110	275
M33x3.5	50	694	104.04	374	343	429	481	515	539	687	1,511	374
M36x4	55	817	122.51	481	441	551	617	662	692	882	1,941	481
M39x4	60	976	146.37	622	571	714	799	856	896	1,142	2,512	622
M42x4.5	65	1121	168.14	770	706	883	989	1,059	1,109	1,412	3,107	770
M45x4.5	70	1306	195.91	961	882	1,102	1,234	1,322	1,384	1,763	3,879	961
M48x5	75	1473	220.98	1,156	1,061	1,326	1,485	1,591	1,665	2,121	4,667	1,156
M52x5	80	1758	263.69	1,495	1,371	1,714	1,920	2,057	2,153	2,742	6,033	1,495
M56x5.5	85	2030	304.52	1,859	1,705	2,132	2,387	2,558	2,677	3,411	7,503	1,859
M60x5.5	90	2362	354.32	2,317	2,126	2,657	2,976	3,189	3,338	4,252	9,354	2,317
M64x6	95	2676	401.41	2,800	2,569	3,211	3,597	3,854	4,033	5,138	11,304	2,800
M68x6	100	3055	458.31	3,397	3,117	3,896	4,363	4,675	4,893	6,233	13,713	3,397
M72x6	105	3460	518.98	4,073	3,737	4,671	5,231	5,605	5,867	7,473	16,441	4,073
M76x6	110	3889	583.42	4,833	4,434	5,542	6,208	6,651	6,961	8,868	19,510	4,833
M80x6	115	4344	651.63	5,682	5,213	6,516	7,298	7,820	8,184	10,426	22,937	5,682
M90x6	130	5591	838.65	8,227	7,548	9,435	10,567	11,322	11,850	15,096	33,210	8,227
M100x6	145	6995	1,049.22	11,437	10,492	13,115	14,689	15,738	16,473	20,984	46,166	11,437
M110x6	155	8556	1,283.36	15,388	14,117	17,646	19,764	21,176	22,164	28,234	62,115	15,388
M125x6	180	11192	1,678.75	22,873	20,984	26,231	29,378	31,477	32,946	41,969	92,331	22,873

TORQUE GUIDE FOR ISO **R898** GRADE **5.6**

MINIMUM YIELD (Mpa) 300

BOLT LOAD BASED ON 60 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	44.07	96	88	110	123	132	138	176	388	96
M22x2.5	32	303	54.61	131	120	150	168	180	189	240	529	131
M24x3	36	353	63.45	166	152	190	213	228	239	305	670	166
M27x3	41	459	82.70	243	223	279	313	335	351	447	982	243
M30x3.5	46	561	100.91	330	303	378	424	454	475	605	1,332	330
M33x3.5	50	694	124.85	449	412	515	577	618	647	824	1,813	449
M36x4	55	817	147.02	577	529	662	741	794	831	1,059	2,329	577
M39x4	60	976	175.64	747	685	856	959	1,028	1,075	1,370	3,014	747
M42x4.5	65	1121	201.77	924	847	1,059	1,186	1,271	1,330	1,695	3,729	924
M45x4.5	70	1306	235.09	1,153	1,058	1,322	1,481	1,587	1,661	2,116	4,655	1,153
M48x5	75	1473	265.18	1,387	1,273	1,591	1,782	1,909	1,998	2,546	5,601	1,387
M52x5	80	1758	316.42	1,793	1,645	2,057	2,304	2,468	2,583	3,291	7,240	1,793
M56x5.5	85	2030	365.42	2,231	2,046	2,558	2,865	3,070	3,213	4,093	9,004	2,231
M60x5.5	90	2362	425.18	2,781	2,551	3,189	3,572	3,827	4,005	5,102	11,225	2,781
M64x6	95	2676	481.70	3,360	3,083	3,854	4,316	4,624	4,840	6,166	13,565	3,360
M68x6	100	3055	549.97	4,076	3,740	4,675	5,236	5,610	5,872	7,480	16,455	4,076
M72x6	105	3460	622.78	4,888	4,484	5,605	6,278	6,726	7,040	8,968	19,730	4,888
M76x6	110	3889	700.11	5,800	5,321	6,651	7,449	7,981	8,354	10,642	23,412	5,800
M80x6	115	4344	781.96	6,819	6,256	7,820	8,758	9,383	9,821	12,511	27,525	6,819
M90x6	130	5591	1,006.38	9,873	9,057	11,322	12,680	13,586	14,220	18,115	39,852	9,873
M100x6	145	6995	1,259.07	13,724	12,591	15,738	17,627	18,886	19,767	25,181	55,399	13,724
M110x6	155	8556	1,540.04	18,465	16,940	21,176	23,717	25,411	26,596	33,881	74,538	18,465
M125x6	180	11192	2,014.50	27,448	25,181	31,477	35,254	37,772	39,535	50,363	110,798	27,448

TORQUE GUIDE FOR ISO **R898** GRADE **5.6**

MINIMUM YIELD (Mpa) 300

BOLT LOAD BASED ON 70 PERCENT YIELD

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	51.41	112	103	129	144	154	161	206	452	112
M22x2.5	32	303	63.72	153	140	175	196	210	220	280	617	153
M24x3	36	353	74.03	194	178	222	249	267	279	355	782	194
M27x3	41	459	96.48	284	260	326	365	391	409	521	1,146	284
M30x3.5	46	561	117.73	385	353	441	494	530	555	706	1,554	385
M33x3.5	50	694	145.65	524	481	601	673	721	755	961	2,115	524
M36x4	55	817	171.52	673	617	772	864	926	969	1,235	2,717	673
M39x4	60	976	204.92	871	799	999	1,119	1,199	1,255	1,598	3,516	871
M42x4.5	65	1121	235.40	1,078	989	1,236	1,384	1,483	1,552	1,977	4,350	1,078
M45x4.5	70	1306	274.27	1,345	1,234	1,543	1,728	1,851	1,938	2,468	5,431	1,345
M48x5	75	1473	309.38	1,619	1,485	1,856	2,079	2,228	2,331	2,970	6,534	1,619
M52x5	80	1758	369.16	2,092	1,920	2,400	2,687	2,879	3,014	3,839	8,446	2,092
M56x5.5	85	2030	426.32	2,602	2,387	2,984	3,342	3,581	3,748	4,775	10,505	2,602
M60x5.5	90	2362	496.04	3,244	2,976	3,720	4,167	4,464	4,673	5,953	13,096	3,244
M64x6	95	2676	561.98	3,920	3,597	4,496	5,035	5,395	5,647	7,193	15,825	3,920
M68x6	100	3055	641.64	4,756	4,363	5,454	6,108	6,545	6,850	8,726	19,198	4,756
M72x6	105	3460	726.57	5,702	5,231	6,539	7,324	7,847	8,213	10,463	23,018	5,702
M76x6	110	3889	816.79	6,766	6,208	7,759	8,691	9,311	9,746	12,415	27,313	6,766
M80x6	115	4344	912.28	7,955	7,298	9,123	10,218	10,947	11,458	14,597	32,112	7,955
M90x6	130	5591	1,174.10	11,518	10,567	13,209	14,794	15,850	16,590	21,134	46,495	11,518
M100x6	145	6995	1,468.91	16,011	14,689	18,361	20,565	22,034	23,062	29,378	64,632	16,011
M110x6	155	8556	1,796.71	21,543	19,764	24,705	27,669	29,646	31,029	39,528	86,961	21,543
M125x6	180	11192	2,350.26	32,022	29,378	36,723	41,129	44,067	46,124	58,756	129,264	32,022

TORQUE GUIDE FOR ISO **R898** GRADE **5.6**

MINIMUM YIELD (Mpa) 300

BOLT LOAD BASED ON 80

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	58.75	128	118	147	165	176	184	235	517	128
M22x2.5	32	303	72.82	175	160	200	224	240	252	320	705	175
M24x3	36	353	84.61	221	203	254	284	305	319	406	893	221
M27x3	41	459	110.26	325	298	372	417	447	467	595	1,310	325
M30x3.5	46	561	134.55	440	404	505	565	605	634	807	1,776	440
M33x3.5	50	694	166.46	599	549	687	769	824	862	1,099	2,417	599
M36x4	55	817	196.02	769	706	882	988	1,059	1,108	1,411	3,105	769
M39x4	60	976	234.19	996	913	1,142	1,279	1,370	1,434	1,827	4,019	996
M42x4.5	65	1121	269.03	1,232	1,130	1,412	1,582	1,695	1,774	2,260	4,972	1,232
M45x4.5	70	1306	313.46	1,537	1,411	1,763	1,975	2,116	2,215	2,821	6,206	1,537
M48x5	75	1473	353.57	1,850	1,697	2,121	2,376	2,546	2,665	3,394	7,467	1,850
M52x5	80	1758	421.90	2,391	2,194	2,742	3,071	3,291	3,444	4,388	9,653	2,391
M56x5.5	85	2030	487.23	2,974	2,728	3,411	3,820	4,093	4,284	5,457	12,005	2,974
M60x5.5	90	2362	566.91	3,708	3,401	4,252	4,762	5,102	5,340	6,803	14,966	3,708
M64x6	95	2676	642.26	4,480	4,110	5,138	5,755	6,166	6,453	8,221	18,086	4,480
M68x6	100	3055	733.30	5,435	4,986	6,233	6,981	7,480	7,829	9,973	21,940	5,435
M72x6	105	3460	830.37	6,517	5,979	7,473	8,370	8,968	9,387	11,957	26,306	6,517
M76x6	110	3889	933.47	7,733	7,094	8,868	9,932	10,642	11,138	14,189	31,215	7,733
M80x6	115	4344	1,042.61	9,092	8,341	10,426	11,677	12,511	13,095	16,682	36,700	9,092
M90x6	130	5591	1,341.83	13,163	12,077	15,096	16,907	18,115	18,960	24,153	53,137	13,163
M100x6	145	6995	1,678.76	18,298	16,788	20,984	23,503	25,181	26,357	33,575	73,865	18,298
M110x6	155	8556	2,053.38	24,620	22,587	28,234	31,622	33,881	35,462	45,174	99,384	24,620
M125x6	180	11192	2,686.01	36,597	33,575	41,969	47,005	50,363	52,713	67,150	147,730	36,597

TORQUE GUIDE FOR ISO **R898** GRADE **5.6**

MINIMUM YIELD (Mpa) 300

BOLT LOAD BASED ON 90

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA (mm)²	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	66.10	144	132	165	185	198	208	264	582	144
M22x2.5	32	303	81.92	196	180	225	252	270	283	360	793	196
M24x3	36	353	95.18	249	228	286	320	343	359	457	1,005	249
M27x3	41	459	124.05	365	335	419	469	502	526	670	1,474	365
M30x3.5	46	561	151.37	495	454	568	636	681	713	908	1,998	495
M33x3.5	50	694	187.27	674	618	772	865	927	970	1,236	2,719	674
M36x4	55	817	220.53	865	794	992	1,111	1,191	1,246	1,588	3,493	865
M39x4	60	976	263.47	1,120	1,028	1,284	1,439	1,541	1,613	2,055	4,521	1,120
M42x4.5	65	1121	302.66	1,386	1,271	1,589	1,780	1,907	1,996	2,542	5,593	1,386
M45x4.5	70	1306	352.64	1,730	1,587	1,984	2,222	2,380	2,491	3,174	6,982	1,730
M48x5	75	1473	397.77	2,081	1,909	2,387	2,673	2,864	2,998	3,819	8,401	2,081
M52x5	80	1758	474.64	2,690	2,468	3,085	3,455	3,702	3,875	4,936	10,860	2,690
M56x5.5	85	2030	548.13	3,346	3,070	3,837	4,297	4,604	4,819	6,139	13,506	3,346
M60x5.5	90	2362	637.77	4,171	3,827	4,783	5,357	5,740	6,008	7,653	16,837	4,171
M64x6	95	2676	722.54	5,040	4,624	5,780	6,474	6,936	7,260	9,249	20,347	5,040
M68x6	100	3055	824.96	6,115	5,610	7,012	7,854	8,415	8,807	11,219	24,683	6,115
M72x6	105	3460	934.17	7,331	6,726	8,408	9,416	10,089	10,560	13,452	29,594	7,331
M76x6	110	3889	1,050.16	8,700	7,981	9,976	11,174	11,972	12,530	15,962	35,117	8,700
M80x6	115	4344	1,172.93	10,228	9,383	11,729	13,137	14,075	14,732	18,767	41,287	10,228
M90x6	130	5591	1,509.56	14,809	13,586	16,983	19,020	20,379	21,330	27,172	59,779	14,809
M100x6	145	6995	1,888.60	20,586	18,886	23,608	26,440	28,329	29,651	37,772	83,099	20,586
M110x6	155	8556	2,310.06	27,698	25,411	31,763	35,575	38,116	39,895	50,821	111,807	27,698
M125x6	180	11192	3,021.76	41,171	37,772	47,215	52,881	56,658	59,302	75,544	166,197	41,171

TORQUE GUIDE FOR ISO **R898** GRADE **5.6**

MINIMUM YIELD (Mpa) 300

BOLT LOAD BASED ON 99

BOLT LOADS

REQUIRED TORQUE (N-m)

BOLT SIZE DIA. x P	HEX NUT ACROSS FLAT (mm)	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	**LoaDISC** TS 801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT 0.109
M20x2.5	30	245	72.71	159	145	182	204	218	228	291	640	159
M22x2.5	32	303	90.11	216	198	248	278	297	311	397	872	216
M24x3	36	353	104.70	274	251	314	352	377	395	503	1,106	274
M27x3	41	459	136.45	402	368	461	516	553	578	737	1,621	402
M30x3.5	46	561	166.50	544	500	624	699	749	784	999	2,198	544
M33x3.5	50	694	206.00	741	680	850	952	1,020	1,067	1,360	2,991	741
M36x4	55	817	242.58	952	873	1,092	1,223	1,310	1,371	1,747	3,842	952
M39x4	60	976	289.81	1,232	1,130	1,413	1,582	1,695	1,775	2,261	4,973	1,232
M42x4.5	65	1121	332.93	1,524	1,398	1,748	1,958	2,097	2,195	2,797	6,152	1,524
M45x4.5	70	1306	387.90	1,903	1,746	2,182	2,444	2,618	2,741	3,491	7,680	1,903
M48x5	75	1473	437.55	2,289	2,100	2,625	2,940	3,150	3,297	4,200	9,241	2,289
M52x5	80	1758	522.10	2,959	2,715	3,394	3,801	4,072	4,262	5,430	11,946	2,959
M56x5.5	85	2030	602.94	3,680	3,376	4,221	4,727	5,065	5,301	6,753	14,856	3,680
M60x5.5	90	2362	701.55	4,588	4,209	5,262	5,893	6,314	6,609	8,419	18,521	4,588
M64x6	95	2676	794.80	5,545	5,087	6,358	7,121	7,630	7,986	10,173	22,381	5,545
M68x6	100	3055	907.46	6,726	6,171	7,713	8,639	9,256	9,688	12,341	27,151	6,726
M72x6	105	3460	1,027.58	8,064	7,399	9,248	10,358	11,098	11,616	14,797	32,554	8,064
M76x6	110	3889	1,155.17	9,569	8,779	10,974	12,291	13,169	13,784	17,559	38,629	9,569
M80x6	115	4344	1,290.23	11,251	10,322	12,902	14,451	15,483	16,205	20,644	45,416	11,251
M90x6	130	5591	1,660.52	16,290	14,945	18,681	20,923	22,417	23,463	29,889	65,757	16,290
M100x6	145	6995	2,077.46	22,644	20,775	25,968	29,085	31,162	32,616	41,549	91,408	22,644
M110x6	155	8556	2,541.06	30,467	27,952	34,940	39,132	41,928	43,884	55,903	122,987	30,467
M125x6	180	11192	3,323.93	45,289	41,549	51,936	58,169	62,324	65,232	83,098	182,816	45,289

BOLT LOAD (METRIC) SOCKET HEAD CAP SCREWS (MATERIAL GR 12.9)

40% - 99% YIELD

HYTORC

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

BOLT LOADS

TORQUE GUIDE FOR **SOCKET HEAD CAP SCREWS (METRIC)**

MATERIAL: **ASTM A 574M** DIN ENISO4762-ALLOY STEEL

PROPERTY CLASS 12.9-ISO 898/1 (Gr. 12.9)

BOLT LOAD BASED ON **60** PERCENT YIELD

REQUIRED TORQUE (N-m)

BOLT SIZE DIA.	THREAD PITCH	HEX ACROSS FLAT	STRESS AREA $(mm)^2$	BOLT LOAD (kN)	LoaDISC TS801 MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.20	DRY STEEL K=.440	CUSTOM INSERT 0.1
M20	2.5	17	245	165.27	360	331	413	463	496	519	661	1,454	331
M24	3	19	353	237.99	623	571	714	800	857	897	1,142	2,513	571
M30	3.5	22	561	378.42	1,237	1,135	1,419	1,589	1,703	1,782	2,270	4,995	1,135
M36	4	27	817	551.32	2,163	1,985	2,481	2,779	2,977	3,116	3,969	8,733	1,985
M42	4.5	32	1121	756.65	3,464	3,178	3,972	4,449	4,767	4,989	6,356	13,983	3,178
M48	5	36	1473	994.42	5,203	4,773	5,967	6,683	7,160	7,494	9,546	21,002	4,773

HYTORC

TORQUE GUIDE FOR ASTM **A449** STUD

BOLT TENSION BASED ON 40 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	92,000	12,302	84	77	96	108	115	121	154	231	115	35	69	115
7/8 x 9	1-7/16"	0.461	92,000	16,983	135	124	155	173	186	194	248	372	186	56	111	186
1x 8	1-5/8"	0.605	92,000	22,280	202	186	232	260	279	291	371	557	279	84	167	279
1-1/8 x 8	1-13/16"	0.790	81,000	25,598	262	240	300	336	360	377	480	720	360	108	216	360
1-1/4 x 8	2"	0.999	81,000	32,374	368	337	422	472	506	529	674	1,012	506	152	304	506
1-3/8 x 8	2-3/16"	1.233	81,000	39,945	499	458	572	641	687	719	915	1,373	687	206	412	687
1-1/2 x 8	2-3/8"	1.491	81,000	48,311	658	604	755	845	906	948	1,208	1,812	906	272	544	906
1-5/8 x 8	2-9/16"	1.774	58,000	41,153	607	557	697	780	836	875	1,115	1,672	836	251	502	836
1-3/4 x 8	2-3/4"	2.081	58,000	48,281	767	704	880	986	1,056	1,105	1,408	2,112	1,056	317	634	1056
1-7/8 x 8	2-15/16"	2.413	58,000	55,979	953	875	1,093	1,225	1,312	1,373	1,749	2,624	1,312	394	787	1312
2 x 8	3-1/8"	2.769	58,000	64,246	1,167	1,071	1,338	1,499	1,606	1,681	2,142	3,212	1,606	482	964	1606
2-1/8 x 8	3-5/16"	3.150	58,000	73,082	1,411	1,294	1,618	1,812	1,941	2,032	2,588	3,882	1,941	582	1165	1941
2-1/4 x 8	3-1/2"	3.555	58,000	82,487	1,686	1,547	1,933	2,165	2,320	2,428	3,093	4,640	2,320	696	1392	2320
2-3/8 x 8	3-11/16"	3.985	58,000	92,462	1,995	1,830	2,287	2,562	2,745	2,873	3,660	5,490	2,745	823	1647	2745
2-1/2 x 8	3-7/8"	4.440	58,000	103,005	2,339	2,146	2,682	3,004	3,219	3,369	4,292	6,438	3,219	966	1931	3219
2-3/4 x 8	4-1/4"	5.422	58,000	125,799	3,142	2,883	3,604	4,036	4,324	4,526	5,766	8,649	4,324	1297	2595	4324
3 x 8	4-5/8"	6.503	58,000	150,870	4,111	3,772	4,715	5,280	5,658	5,922	7,544	11,315	5,658	1697	3395	5658

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

REV 7.31.09

This spread sheet is to be used as a guide. all results should be analyzed against actual field results to establish their validity.
To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
If 'K' factor is not listed, Enter appropriate value under Custom (insert K) , in yellow field only
as always- after entering any value, click outside the field or hit enter to update calculations.
NOTICE: Spread sheet is active and unprotected. Any alterations to cells other than those shown in yellow could produce incorrect results.

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TORQUE GUIDE FOR ASTM **A449** STUD

BOLT TENSION BASED ON 50 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	92,000	15,377	105	96	120	135	144	151	192	288	144	43	86	144
7/8 x 9	1-7/16"	0.461	92,000	21,229	169	155	193	217	232	243	310	464	232	70	139	232
1x 8	1-5/8"	0.605	92,000	27,850	253	232	290	325	348	364	464	696	348	104	209	348
1-1/8 x 8	1-13/16"	0.790	81,000	31,997	327	300	375	420	450	471	600	900	450	135	270	450
1-1/4 x 8	2"	0.999	81,000	40,468	459	422	527	590	632	662	843	1,265	632	190	379	632
1-3/8 x 8	2-3/16"	1.233	81,000	49,931	624	572	715	801	858	898	1,144	1,716	858	257	515	858
1-1/2 x 8	2-3/8"	1.491	81,000	60,389	823	755	944	1,057	1,132	1,185	1,510	2,265	1,132	340	679	1132
1-5/8 x 8	2-9/16"	1.774	58,000	51,441	759	697	871	975	1,045	1,094	1,393	2,090	1,045	313	627	1045
1-3/4 x 8	2-3/4"	2.081	58,000	60,352	959	880	1,100	1,232	1,320	1,382	1,760	2,640	1,320	396	792	1320
1-7/8 x 8	2-15/16"	2.413	58,000	69,974	1,192	1,093	1,367	1,531	1,640	1,717	2,187	3,280	1,640	492	984	1640
2 x 8	3-1/8"	2.769	58,000	80,308	1,459	1,338	1,673	1,874	2,008	2,101	2,677	4,015	2,008	602	1205	2008
2-1/8 x 8	3-5/16"	3.150	58,000	91,353	1,763	1,618	2,022	2,265	2,427	2,540	3,235	4,853	2,427	728	1456	2427
2-1/4 x 8	3-1/2"	3.555	58,000	103,109	2,107	1,933	2,417	2,707	2,900	3,035	3,867	5,800	2,900	870	1740	2900
2-3/8 x 8	3-11/16"	3.985	58,000	115,577	2,493	2,287	2,859	3,202	3,431	3,591	4,575	6,862	3,431	1029	2059	3431
2-1/2 x 8	3-7/8"	4.440	58,000	128,756	2,924	2,682	3,353	3,755	4,024	4,211	5,365	8,047	4,024	1207	2414	4024
2-3/4 x 8	4-1/4"	5.422	58,000	157,249	3,928	3,604	4,505	5,045	5,405	5,658	7,207	10,811	5,405	1622	3243	5405
3 x 8	4-5/8"	6.503	58,000	188,588	5,139	4,715	5,893	6,601	7,072	7,402	9,429	14,144	7,072	2122	4243	7072

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

REV 7.31.09

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HYTORC

TORQUE GUIDE FOR ASTM **A449** STUD BOLT TENSION BASED ON 60 % YIELD					REQUIRED TORQUE (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	92,000	18,453	126	115	144	161	173	181	231	346	173	52	104	173
7/8 x 9	1-7/16"	0.461	92,000	25,475	202	186	232	260	279	292	372	557	279	84	167	279
1x 8	1-5/8"	0.605	92,000	33,420	304	279	348	390	418	437	557	836	418	125	251	418
1-1/8 x 8	1-13/16"	0.790	81,000	38,397	392	360	450	504	540	565	720	1,080	540	162	324	540
1-1/4 x 8	2"	0.999	81,000	48,561	551	506	632	708	759	794	1,012	1,518	759	228	455	759
1-3/8 x 8	2-3/16"	1.233	81,000	59,918	748	687	858	961	1,030	1,078	1,373	2,060	1,030	309	618	1030
1-1/2 x 8	2-3/8"	1.491	81,000	72,467	987	906	1,132	1,268	1,359	1,422	1,812	2,718	1,359	408	815	1359
1-5/8 x 8	2-9/16"	1.774	58,000	61,729	911	836	1,045	1,170	1,254	1,312	1,672	2,508	1,254	376	752	1254
1-3/4 x 8	2-3/4"	2.081	58,000	72,422	1,151	1,056	1,320	1,479	1,584	1,658	2,112	3,168	1,584	475	951	1584
1-7/8 x 8	2-15/16"	2.413	58,000	83,969	1,430	1,312	1,640	1,837	1,968	2,060	2,624	3,936	1,968	590	1181	1968
2 x 8	3-1/8"	2.769	58,000	96,369	1,751	1,606	2,008	2,249	2,409	2,522	3,212	4,818	2,409	723	1446	2409
2-1/8 x 8	3-5/16"	3.150	58,000	109,623	2,116	1,941	2,427	2,718	2,912	3,048	3,882	5,824	2,912	874	1747	2912
2-1/4 x 8	3-1/2"	3.555	58,000	123,731	2,529	2,320	2,900	3,248	3,480	3,642	4,640	6,960	3,480	1044	2088	3480
2-3/8 x 8	3-11/16"	3.985	58,000	138,693	2,992	2,745	3,431	3,843	4,117	4,310	5,490	8,235	4,117	1235	2470	4117
2-1/2 x 8	3-7/8"	4.440	58,000	154,508	3,509	3,219	4,024	4,506	4,828	5,054	6,438	9,657	4,828	1449	2897	4828
2-3/4 x 8	4-1/4"	5.422	58,000	188,699	4,714	4,324	5,405	6,054	6,487	6,789	8,649	12,973	6,487	1946	3892	6487
3 x 8	4-5/8"	6.503	58,000	226,305	6,167	5,658	7,072	7,921	8,486	8,882	11,315	16,973	8,486	2546	5092	8486

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TORQUE GUIDE FOR ASTM **A449** STUD BOLT TENSION BASED ON 70 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN²)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	92,000	21,528	147	135	168	188	202	211	269	404	202	61	121	202
7/8 x 9	1-7/16"	0.461	92,000	29,721	236	217	271	303	325	340	433	650	325	98	195	325
1x 8	1-5/8"	0.605	92,000	38,990	354	325	406	455	487	510	650	975	487	146	292	487
1-1/8 x 8	1-13/16"	0.790	81,000	44,796	458	420	525	588	630	659	840	1,260	630	189	378	630
1-1/4 x 8	2"	0.999	81,000	56,655	643	590	738	826	885	927	1,180	1,770	885	266	531	885
1-3/8 x 8	2-3/16"	1.233	81,000	69,904	873	801	1,001	1,121	1,201	1,258	1,602	2,403	1,201	360	721	1201
1-1/2 x 8	2-3/8"	1.491	81,000	84,544	1,152	1,057	1,321	1,480	1,585	1,659	2,114	3,170	1,585	476	951	1585
1-5/8 x 8	2-9/16"	1.774	58,000	72,017	1,063	975	1,219	1,365	1,463	1,531	1,950	2,926	1,463	439	878	1463
1-3/4 x 8	2-3/4"	2.081	58,000	84,492	1,343	1,232	1,540	1,725	1,848	1,935	2,464	3,697	1,848	554	1109	1848
1-7/8 x 8	2-15/16"	2.413	58,000	97,964	1,668	1,531	1,913	2,143	2,296	2,403	3,061	4,592	2,296	689	1378	2296
2 x 8	3-1/8"	2.769	58,000	112,431	2,042	1,874	2,342	2,623	2,811	2,942	3,748	5,622	2,811	843	1686	2811
2-1/8 x 8	3-5/16"	3.150	58,000	127,894	2,469	2,265	2,831	3,171	3,397	3,556	4,530	6,794	3,397	1019	2038	3397
2-1/4 x 8	3-1/2"	3.555	58,000	144,353	2,950	2,707	3,383	3,789	4,060	4,249	5,413	8,120	4,060	1218	2436	4060
2-3/8 x 8	3-11/16"	3.985	58,000	161,808	3,491	3,202	4,003	4,483	4,804	5,028	6,405	9,607	4,804	1441	2882	4804
2-1/2 x 8	3-7/8"	4.440	58,000	180,259	4,093	3,755	4,694	5,258	5,633	5,896	7,511	11,266	5,633	1690	3380	5633
2-3/4 x 8	4-1/4"	5.422	58,000	220,149	5,499	5,045	6,306	7,063	7,568	7,921	10,090	15,135	7,568	2270	4541	7568
3 x 8	4-5/8"	6.503	58,000	264,023	7,195	6,601	8,251	9,241	9,901	10,363	13,201	19,802	9,901	2970	5941	9901

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TORQUE GUIDE FOR ASTM **A449** STUD

BOLT TENSION BASED ON 80 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	92,000	24,604	168	154	192	215	231	241	308	461	231	69	138	231
7/8 x 9	1-7/16"	0.461	92,000	33,966	270	248	310	347	372	389	495	743	372	111	223	372
1x 8	1-5/8"	0.605	92,000	44,560	405	371	464	520	557	583	743	1,114	557	167	334	557
1-1/8 x 8	1-13/16"	0.790	81,000	51,195	523	480	600	672	720	754	960	1,440	720	216	432	720
1-1/4 x 8	2"	0.999	81,000	64,748	735	674	843	944	1,012	1,059	1,349	2,023	1,012	304	607	1012
1-3/8 x 8	2-3/16"	1.233	81,000	79,890	998	915	1,144	1,282	1,373	1,437	1,831	2,746	1,373	412	824	1373
1-1/2 x 8	2-3/8"	1.491	81,000	96,622	1,316	1,208	1,510	1,691	1,812	1,896	2,416	3,623	1,812	544	1087	1812
1-5/8 x 8	2-9/16"	1.774	58,000	82,305	1,215	1,115	1,393	1,560	1,672	1,750	2,229	3,344	1,672	502	1003	1672
1-3/4 x 8	2-3/4"	2.081	58,000	96,563	1,535	1,408	1,760	1,971	2,112	2,211	2,816	4,225	2,112	634	1267	2112
1-7/8 x 8	2-15/16"	2.413	58,000	111,958	1,907	1,749	2,187	2,449	2,624	2,746	3,499	5,248	2,624	787	1574	2624
2 x 8	3-1/8"	2.769	58,000	128,492	2,334	2,142	2,677	2,998	3,212	3,362	4,283	6,425	3,212	964	1927	3212
2-1/8 x 8	3-5/16"	3.150	58,000	146,164	2,821	2,588	3,235	3,624	3,882	4,064	5,177	7,765	3,882	1165	2329	3882
2-1/4 x 8	3-1/2"	3.555	58,000	164,975	3,372	3,093	3,867	4,331	4,640	4,856	6,187	9,280	4,640	1392	2784	4640
2-3/8 x 8	3-11/16"	3.985	58,000	184,923	3,989	3,660	4,575	5,124	5,490	5,746	7,320	10,980	5,490	1647	3294	5490
2-1/2 x 8	3-7/8"	4.440	58,000	206,010	4,678	4,292	5,365	6,009	6,438	6,738	8,584	12,876	6,438	1931	3863	6438
2-3/4 x 8	4-1/4"	5.422	58,000	251,599	6,285	5,766	7,207	8,072	8,649	9,052	11,532	17,297	8,649	2595	5189	8649
3 x 8	4-5/8"	6.503	58,000	301,740	8,222	7,544	9,429	10,561	11,315	11,843	15,087	22,631	11,315	3395	6789	11315

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TORQUE GUIDE FOR ASTM **A449** STUD

BOLT TENSION BASED ON 90 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	92,000	27,679	189	173	216	242	259	272	346	519	259	78	156	259
7/8 x 9	1-7/16"	0.461	92,000	38,212	304	279	348	390	418	437	557	836	418	125	251	418
1x 8	1-5/8"	0.605	92,000	50,130	455	418	522	585	627	656	836	1,253	627	188	376	627
1-1/8 x 8	1-13/16"	0.790	81,000	57,595	589	540	675	756	810	848	1,080	1,620	810	243	486	810
1-1/4 x 8	2"	0.999	81,000	72,842	827	759	948	1,062	1,138	1,191	1,518	2,276	1,138	341	683	1138
1-3/8 x 8	2-3/16"	1.233	81,000	89,877	1,123	1,030	1,287	1,442	1,545	1,617	2,060	3,090	1,545	463	927	1545
1-1/2 x 8	2-3/8"	1.491	81,000	108,700	1,481	1,359	1,698	1,902	2,038	2,133	2,718	4,076	2,038	611	1223	2038
1-5/8 x 8	2-9/16"	1.774	58,000	92,594	1,367	1,254	1,567	1,755	1,881	1,969	2,508	3,762	1,881	564	1128	1881
1-3/4 x 8	2-3/4"	2.081	58,000	108,633	1,727	1,584	1,980	2,218	2,376	2,487	3,168	4,753	2,376	713	1426	2376
1-7/8 x 8	2-15/16"	2.413	58,000	125,953	2,145	1,968	2,460	2,755	2,952	3,090	3,936	5,904	2,952	886	1771	2952
2 x 8	3-1/8"	2.769	58,000	144,554	2,626	2,409	3,012	3,373	3,614	3,782	4,818	7,228	3,614	1084	2168	3614
2-1/8 x 8	3-5/16"	3.150	58,000	164,435	3,174	2,912	3,640	4,077	4,368	4,572	5,824	8,736	4,368	1310	2621	4368
2-1/4 x 8	3-1/2"	3.555	58,000	185,597	3,793	3,480	4,350	4,872	5,220	5,464	6,960	10,440	5,220	1566	3132	5220
2-3/8 x 8	3-11/16"	3.985	58,000	208,039	4,488	4,117	5,147	5,764	6,176	6,464	8,235	12,352	6,176	1853	3706	6176
2-1/2 x 8	3-7/8"	4.440	58,000	231,762	5,263	4,828	6,035	6,760	7,243	7,581	9,657	14,485	7,243	2173	4346	7243
2-3/4 x 8	4-1/4"	5.422	58,000	283,049	7,070	6,487	8,108	9,081	9,730	10,184	12,973	19,460	9,730	2919	5838	9730
3 x 8	4-5/8"	6.503	58,000	339,458	9,250	8,486	10,608	11,881	12,730	13,324	16,973	25,459	12,730	3819	7638	12730

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TORQUE GUIDE FOR ASTM **A449** STUD BOLT TENSION BASED ON 99 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	92,000	30,447	207	190	238	266	285	299	381	571	285	86	171	285
7/8 x 9	1-7/16"	0.461	92,000	42,033	334	306	383	429	460	481	613	919	460	138	276	460
1x 8	1-5/8"	0.605	92,000	55,143	501	460	574	643	689	721	919	1,379	689	207	414	689
1-1/8 x 8	1-13/16"	0.790	81,000	63,354	647	594	742	832	891	932	1,188	1,782	891	267	535	891
1-1/4 x 8	2"	0.999	81,000	80,126	910	835	1,043	1,168	1,252	1,310	1,669	2,504	1,252	376	751	1252
1-3/8 x 8	2-3/16"	1.233	81,000	98,864	1,235	1,133	1,416	1,586	1,699	1,779	2,266	3,398	1,699	510	1020	1699
1-1/2 x 8	2-3/8"	1.491	81,000	119,570	1,629	1,495	1,868	2,092	2,242	2,347	2,989	4,484	2,242	673	1345	2242
1-5/8 x 8	2-9/16"	1.774	58,000	101,853	1,503	1,379	1,724	1,931	2,069	2,165	2,759	4,138	2,069	621	1241	2069
1-3/4 x 8	2-3/4"	2.081	58,000	119,496	1,899	1,743	2,178	2,440	2,614	2,736	3,485	5,228	2,614	784	1568	2614
1-7/8 x 8	2-15/16"	2.413	58,000	138,549	2,360	2,165	2,706	3,031	3,247	3,399	4,330	6,494	3,247	974	1948	3247
2 x 8	3-1/8"	2.769	58,000	159,009	2,889	2,650	3,313	3,710	3,975	4,161	5,300	7,950	3,975	1193	2385	3975
2-1/8 x 8	3-5/16"	3.150	58,000	180,878	3,491	3,203	4,004	4,484	4,805	5,029	6,406	9,609	4,805	1441	2883	4805
2-1/4 x 8	3-1/2"	3.555	58,000	204,156	4,172	3,828	4,785	5,359	5,742	6,010	7,656	11,484	5,742	1723	3445	5742
2-3/8 x 8	3-11/16"	3.985	58,000	228,843	4,937	4,529	5,661	6,341	6,794	7,111	9,058	13,588	6,794	2038	4076	6794
2-1/2 x 8	3-7/8"	4.440	58,000	254,938	5,789	5,311	6,639	7,436	7,967	8,339	10,622	15,934	7,967	2390	4780	7967
2-3/4 x 8	4-1/4"	5.422	58,000	311,354	7,777	7,135	8,919	9,989	10,703	11,202	14,270	21,406	10,703	3211	6422	10703
3 x 8	4-5/8"	6.503	58,000	373,404	10,175	9,335	11,669	13,069	14,003	14,656	18,670	28,005	14,003	4201	8402	14003

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TORQUE GUIDE FOR ASTM **A490** STUD

BOLT TENSION BASED ON 40 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	130,000	17,383	118	109	136	152	163	171	217	326	163	49	98	163
7/8 x 9	1-7/16"	0.461	130,000	23,998	191	175	219	245	262	275	350	525	262	79	157	262
1x 8	1-5/8"	0.605	130,000	31,483	286	262	328	367	394	412	525	787	394	118	236	394
1-1/8 x 8	1-13/16"	0.790	130,000	41,083	420	385	481	539	578	605	770	1,155	578	173	347	578
1-1/4 x 8	2"	0.999	130,000	51,958	590	541	677	758	812	850	1,082	1,624	812	244	487	812
1-3/8 x 8	2-3/16"	1.233	130,000	64,110	801	735	918	1,028	1,102	1,153	1,469	2,204	1,102	331	661	1102
1-1/2 x 8	2-3/8"	1.491	130,000	77,536	1,056	969	1,212	1,357	1,454	1,522	1,938	2,908	1,454	436	872	1454

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

REV 7.31.09

This spread sheet is to be used as a guide. all results should be analyzed against actual field results to establish their validity.
To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
If 'K' factor is not listed, Enter appropriate value under Custom (insert K) , in yellow field only
as always- after entering any value, click outside the field or hit enter to update calculations.
NOTICE: Spread sheet is active and unprotected. Any alterations to cells other than those shown in yellow could produce incorrect results.

TORQUE GUIDE FOR ASTM **A490** STUD BOLT TENSION BASED ON 50 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	130,000	21,729	148	136	170	190	204	213	272	407	204	61	122	204
7/8 x 9	1-7/16"	0.461	130,000	29,997	238	219	273	306	328	343	437	656	328	98	197	328
1x 8	1-5/8"	0.605	130,000	39,353	357	328	410	459	492	515	656	984	492	148	295	492
1-1/8 x 8	1-13/16"	0.790	130,000	51,353	525	481	602	674	722	756	963	1,444	722	217	433	722
1-1/4 x 8	2"	0.999	130,000	64,948	737	677	846	947	1,015	1,062	1,353	2,030	1,015	304	609	1015
1-3/8 x 8	2-3/16"	1.233	130,000	80,137	1,001	918	1,148	1,286	1,377	1,442	1,836	2,755	1,377	413	826	1377
1-1/2 x 8	2-3/8"	1.491	130,000	96,920	1,321	1,212	1,514	1,696	1,817	1,902	2,423	3,635	1,817	545	1090	1817

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

REV 7.31.09

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To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
If 'K' factor is not listed, Enter appropriate value under Custom (insert K) , in yellow field only
as always- after entering any value, click outside the field or hit enter to update calculations.
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TORQUE GUIDE FOR ASTM **A490** STUD BOLT TENSION BASED ON 60 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.15 7	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	130,000	26,075	178	163	204	228	244	256	326	489	244	73	147	244
7/8 x 9	1-7/16"	0.461	130,000	35,997	286	262	328	367	394	412	525	787	394	118	236	394
1x 8	1-5/8"	0.605	130,000	47,224	429	394	492	551	590	618	787	1,181	590	177	354	590
1-1/8 x 8	1-13/16"	0.790	130,000	61,624	630	578	722	809	867	907	1,155	1,733	867	260	520	867
1-1/4 x 8	2"	0.999	130,000	77,937	885	812	1,015	1,137	1,218	1,275	1,624	2,436	1,218	365	731	1218
1-3/8 x 8	2-3/16"	1.233	130,000	96,164	1,201	1,102	1,377	1,543	1,653	1,730	2,204	3,306	1,653	496	992	1653
1-1/2 x 8	2-3/8"	1.491	130,000	116,305	1,585	1,454	1,817	2,035	2,181	2,282	2,908	4,361	2,181	654	1308	2181

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

REV 7.31.09

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To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
If 'K' factor is not listed, Enter appropriate value under Custom (insert K) , in yellow field only
as always- after entering any value, click outside the field or hit enter to update calculations.
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TORQUE GUIDE FOR ASTM **A490** STUD BOLT TENSION BASED ON 70 % YIELD					REQUIRED TORQUE (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	130,000	30,420	207	190	238	266	285	299	380	570	285	86	171	285
7/8 x 9	1-7/16"	0.461	130,000	41,996	334	306	383	429	459	481	612	919	459	138	276	459
1x 8	1-5/8"	0.605	130,000	55,095	500	459	574	643	689	721	918	1,377	689	207	413	689
1-1/8 x 8	1-13/16"	0.790	130,000	71,895	735	674	843	944	1,011	1,058	1,348	2,022	1,011	303	607	1011
1-1/4 x 8	2"	0.999	130,000	90,927	1,032	947	1,184	1,326	1,421	1,487	1,894	2,841	1,421	426	852	1421
1-3/8 x 8	2-3/16"	1.233	130,000	112,192	1,401	1,286	1,607	1,800	1,928	2,018	2,571	3,857	1,928	578	1157	1928
1-1/2 x 8	2-3/8"	1.491	130,000	135,689	1,849	1,696	2,120	2,375	2,544	2,663	3,392	5,088	2,544	763	1526	2544

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
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Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

REV 7.31.09

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Enter the desired percent yield in yellow field at top of form
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TORQUE GUIDE FOR ASTM **A490** STUD BOLT TENSION BASED ON 80 % YIELD					REQUIRED TORQUE (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	130,000	34,766	237	217	272	304	326	341	435	652	326	98	196	326
7/8 x 9	1-7/16"	0.461	130,000	47,996	381	350	437	490	525	549	700	1,050	525	157	315	525
1x 8	1-5/8"	0.605	130,000	62,965	572	525	656	735	787	824	1,049	1,574	787	236	472	787
1-1/8 x 8	1-13/16"	0.790	130,000	82,165	840	770	963	1,078	1,155	1,209	1,541	2,311	1,155	347	693	1155
1-1/4 x 8	2"	0.999	130,000	103,917	1,180	1,082	1,353	1,515	1,624	1,699	2,165	3,247	1,624	487	974	1624
1-3/8 x 8	2-3/16"	1.233	130,000	128,219	1,601	1,469	1,836	2,057	2,204	2,307	2,938	4,408	2,204	661	1322	2204
1-1/2 x 8	2-3/8"	1.491	130,000	155,073	2,113	1,938	2,423	2,714	2,908	3,043	3,877	5,815	2,908	872	1745	2908

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
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REV 7.31.09

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TORQUE GUIDE FOR ASTM **A490** STUD

BOLT TENSION BASED ON 90 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN²)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	130,000	39,112	266	244	306	342	367	384	489	733	367	110	220	367
7/8 x 9	1-7/16"	0.461	130,000	53,995	429	394	492	551	591	618	787	1,181	591	177	354	591
1x 8	1-5/8"	0.605	130,000	70,836	643	590	738	826	885	927	1,181	1,771	885	266	531	885
1-1/8 x 8	1-13/16"	0.790	130,000	92,436	945	867	1,083	1,213	1,300	1,361	1,733	2,600	1,300	390	780	1300
1-1/4 x 8	2"	0.999	130,000	116,906	1,327	1,218	1,522	1,705	1,827	1,912	2,436	3,653	1,827	548	1096	1827
1-3/8 x 8	2-3/16"	1.233	130,000	144,246	1,802	1,653	2,066	2,314	2,479	2,595	3,306	4,958	2,479	744	1488	2479
1-1/2 x 8	2-3/8"	1.491	130,000	174,457	2,377	2,181	2,726	3,053	3,271	3,424	4,361	6,542	3,271	981	1963	3271

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REV 7.31.09

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TORQUE GUIDE FOR ASTM **A490** STUD

BOLT TENSION BASED ON 99 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN²)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300	First Pass	Second Pass	All Subsequent Passes
													0.15	**30%**	**60%**	**100%**
3/4 x 10	1-1/4"	0.334	130,000	43,023	293	269	336	376	403	422	538	807	403	121	242	403
7/8 x 9	1-7/16"	0.461	130,000	59,395	472	433	541	606	650	680	866	1,299	650	195	390	650
1x 8	1-5/8"	0.605	130,000	77,920	708	649	812	909	974	1,019	1,299	1,948	974	292	584	974
1-1/8 x 8	1-13/16"	0.790	130,000	101,680	1,039	953	1,192	1,335	1,430	1,497	1,906	2,860	1,430	429	858	1430
1-1/4 x 8	2"	0.999	130,000	128,597	1,460	1,340	1,674	1,875	2,009	2,103	2,679	4,019	2,009	603	1206	2009
1-3/8 x 8	2-3/16"	1.233	130,000	158,671	1,982	1,818	2,273	2,545	2,727	2,854	3,636	5,454	2,727	818	1636	2727
1-1/2 x 8	2-3/8"	1.491	130,000	191,902	2,615	2,399	2,998	3,358	3,598	3,766	4,798	7,196	3,598	1079	2159	3598

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REV 7.31.09

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TORQUE GUIDE FOR ASTM **A193** GRADE **B7** STUD BOLT TENSION BASED ON 40 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
5/8 x 11	1-1/16"	0.226	105,000	9,492	65	59	74	83	89	93	119	178	89	27	53	89
3/4 x 10	1-1/4"	0.334	105,000	14,040	96	88	110	123	132	138	176	263	132	39	79	132
7/8 x 9	1-7/16"	0.461	105,000	19,383	154	141	177	198	212	222	283	424	212	64	127	212
1x 8	1-5/8"	0.605	105,000	25,428	231	212	265	297	318	333	424	636	318	95	191	318
1-1/8 x 8	1-13/16"	0.790	105,000	33,182	339	311	389	436	467	488	622	933	467	140	280	467
1-1/4 x 8	2"	0.999	105,000	41,966	476	437	546	612	656	686	874	1,311	656	197	393	656
1-3/8 x 8	2-3/16"	1.233	105,000	51,781	647	593	742	831	890	932	1,187	1,780	890	267	534	890
1-1/2 x 8	2-3/8"	1.491	105,000	62,626	853	783	979	1,096	1,174	1,229	1,566	2,348	1,174	352	705	1174
1-5/8 x 8	2-9/16"	1.774	105,000	74,501	1,100	1,009	1,261	1,412	1,513	1,584	2,018	3,027	1,513	454	908	1513
1-3/4 x 8	2-3/4"	2.081	105,000	87,406	1,389	1,275	1,593	1,785	1,912	2,001	2,549	3,824	1,912	574	1147	1912
1-7/8 x 8	2-15/16"	2.413	105,000	101,342	1,726	1,583	1,979	2,217	2,375	2,486	3,167	4,750	2,375	713	1425	2375
2 x 8	3-1/8"	2.769	105,000	116,308	2,113	1,938	2,423	2,714	2,908	3,043	3,877	5,815	2,908	872	1745	2908
2-1/8 x 8	3-5/16"	3.150	105,000	132,304	2,554	2,343	2,929	3,280	3,514	3,678	4,686	7,029	3,514	1054	2109	3514
2-1/4 x 8	3-1/2"	3.555	105,000	149,331	3,052	2,800	3,500	3,920	4,200	4,396	5,600	8,400	4,200	1260	2520	4200
2-3/8 x 8	3-11/16"	3.985	105,000	167,388	3,611	3,313	4,141	4,638	4,969	5,201	6,626	9,939	4,969	1491	2982	4969
2-1/2 x 8	3-7/8"	4.440	95,000	168,715	3,831	3,515	4,394	4,921	5,272	5,518	7,030	10,545	5,272	1582	3163	5272
2-3/4 x 8	4-1/4"	5.422	95,000	206,051	5,147	4,722	5,902	6,611	7,083	7,414	9,444	14,166	7,083	2125	4250	7083
3 x 8	4-5/8"	6.503	95,000	247,115	6,734	6,178	7,722	8,649	9,267	9,699	12,356	18,534	9,267	2780	5560	9267
3-1/4 x 8	5"	7.682	95,000	291,908	8,617	7,906	9,882	11,068	11,859	12,412	15,812	23,718	11,859	3558	7115	11859
3-1/2 x 8	5-3/8"	8.959	95,000	340,429	10,823	9,929	12,411	13,901	14,894	15,589	19,858	29,788	14,894	4468	8936	14894
3-3/4 x 8	5-3/4"	10.334	95,000	392,680	13,376	12,271	15,339	17,180	18,407	19,266	24,542	36,814	18,407	5522	11044	18407
4 x 8	6-1/8"	11.807	95,000	448,659	16,301	14,955	18,694	20,937	22,433	23,480	29,911	44,866	22,433	6730	13460	22433
4-1/4 x 8	6-1/2"	13.378	75,000	401,342	15,493	14,214	17,768	19,900	21,321	22,316	28,428	42,643	21,321	6396	12793	21321
4-1/2 x 8	6-7/8"	15.047	75,000	451,424	18,452	16,928	21,160	23,700	25,393	26,578	33,857	50,785	25,393	7618	15236	25393
4-3/4 x 8	7-1/4"	16.815	75,000	504,449	21,765	19,968	24,960	27,955	29,952	31,349	39,936	59,903	29,952	8986	17971	29952
5 x 8	7-5/8"	18.681	75,000	560,418	25,452	23,351	29,188	32,691	35,026	36,661	46,702	70,052	35,026	10508	21016	35026
5-1/4 x 8	8"	20.644	75,000	619,331	29,534	27,096	33,870	37,934	40,644	42,540	54,191	81,287	40,644	12193	24386	40644
5-1/2 x 8	8-3/8"	22.706	75,000	681,188	34,031	31,221	39,026	43,710	46,832	49,017	62,442	93,663	46,832	14049	28099	46832
5-3/4 x 8	8-3/4"	24.866	75,000	745,988	38,962	35,745	44,682	50,043	53,618	56,120	71,491	107,236	53,618	16085	32171	53618
6 x 8	9-1/8"	27.124	75,000	813,732	44,348	40,687	50,858	56,961	61,030	63,878	81,373	122,060	61,030	18309	36618	61030

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
If 'K' factor is not listed, Enter appropriate value under Custom (insert K) , in yellow field only
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TORQUE GUIDE FOR ASTM **A193** GRADE **B7** STUD BOLT TENSION BASED ON 50 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
5/8 x 11	1-1/16"	0.226	105,000	11,865	81	74	93	104	111	116	148	222	111	33	67	111
3/4 x 10	1-1/4"	0.334	105,000	17,550	120	110	137	154	165	172	219	329	165	49	99	165
7/8 x 9	1-7/16"	0.461	105,000	24,229	193	177	221	247	265	277	353	530	265	80	159	265
1x 8	1-5/8"	0.605	105,000	31,785	289	265	331	371	397	416	530	795	397	119	238	397
1-1/8 x 8	1-13/16"	0.790	105,000	41,478	424	389	486	544	583	611	778	1,167	583	175	350	583
1-1/4 x 8	2"	0.999	105,000	52,458	596	546	683	765	820	858	1,093	1,639	820	246	492	820
1-3/8 x 8	2-3/16"	1.233	105,000	64,726	808	742	927	1,038	1,112	1,164	1,483	2,225	1,112	334	667	1112
1-1/2 x 8	2-3/8"	1.491	105,000	78,282	1,067	979	1,223	1,370	1,468	1,536	1,957	2,936	1,468	440	881	1468
1-5/8 x 8	2-9/16"	1.774	105,000	93,126	1,375	1,261	1,576	1,766	1,892	1,980	2,522	3,783	1,892	567	1135	1892
1-3/4 x 8	2-3/4"	2.081	105,000	109,257	1,737	1,593	1,992	2,231	2,390	2,502	3,187	4,780	2,390	717	1434	2390
1-7/8 x 8	2-15/16"	2.413	105,000	126,677	2,157	1,979	2,474	2,771	2,969	3,108	3,959	5,938	2,969	891	1781	2969
2 x 8	3-1/8"	2.769	105,000	145,385	2,641	2,423	3,029	3,392	3,635	3,804	4,846	7,269	3,635	1090	2181	3635
2-1/8 x 8	3-5/16"	3.150	105,000	165,380	3,192	2,929	3,661	4,100	4,393	4,598	5,857	8,786	4,393	1318	2636	4393
2-1/4 x 8	3-1/2"	3.555	105,000	186,663	3,815	3,500	4,375	4,900	5,250	5,495	7,000	10,500	5,250	1575	3150	5250
2-3/8 x 8	3-11/16"	3.985	105,000	209,234	4,514	4,141	5,176	5,798	6,212	6,502	8,282	12,423	6,212	1863	3727	6212
2-1/2 x 8	3-7/8"	4.440	95,000	210,894	4,789	4,394	5,492	6,151	6,590	6,898	8,787	13,181	6,590	1977	3954	6590
2-3/4 x 8	4-1/4"	5.422	95,000	257,563	6,434	5,902	7,378	8,263	8,854	9,267	11,805	17,707	8,854	2656	5312	8854
3 x 8	4-5/8"	6.503	95,000	308,894	8,417	7,722	9,653	10,811	11,584	12,124	15,445	23,167	11,584	3475	6950	11584
3-1/4 x 8	5"	7.682	95,000	364,885	10,772	9,882	12,353	13,835	14,823	15,515	19,765	29,647	14,823	4447	8894	14823
3-1/2 x 8	5-3/8"	8.959	95,000	425,537	13,529	12,411	15,514	17,376	18,617	19,486	24,823	37,234	18,617	5585	11170	18617
3-3/4 x 8	5-3/4"	10.334	95,000	490,850	16,720	15,339	19,174	21,475	23,009	24,082	30,678	46,017	23,009	6903	13805	23009
4 x 8	6-1/8"	11.807	95,000	560,824	20,377	18,694	23,368	26,172	28,041	29,350	37,388	56,082	28,041	8412	16825	28041
4-1/4 x 8	6-1/2"	13.378	75,000	501,678	19,367	17,768	22,210	24,875	26,652	27,895	35,536	53,303	26,652	7995	15991	26652
4-1/2 x 8	6-7/8"	15.047	75,000	564,280	23,065	21,160	26,451	29,625	31,741	33,222	42,321	63,481	31,741	9522	19044	31741
4-3/4 x 8	7-1/4"	16.815	75,000	630,562	27,206	24,960	31,200	34,944	37,440	39,187	49,919	74,879	37,440	11232	22464	37440
5 x 8	7-5/8"	18.681	75,000	700,523	31,815	29,188	36,486	40,864	43,783	45,826	58,377	87,565	43,783	13135	26270	43783
5-1/4 x 8	8"	20.644	75,000	774,164	36,918	33,870	42,337	47,418	50,805	53,175	67,739	101,609	50,805	15241	30483	50805
5-1/2 x 8	8-3/8"	22.706	75,000	851,485	42,539	39,026	48,783	54,637	58,540	61,271	78,053	117,079	58,540	17562	35124	58540
5-3/4 x 8	8-3/4"	24.866	75,000	932,485	48,703	44,682	55,852	62,554	67,022	70,150	89,363	134,045	67,022	20107	40213	67022
6 x 8	9-1/8"	27.124	75,000	1,017,165	55,436	50,858	63,573	71,202	76,287	79,847	101,717	152,575	76,287	22886	45772	76287

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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TORQUE GUIDE FOR ASTM **A193** GRADE **B7** STUD

BOLT TENSION BASED ON 60 % YIELD

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**REQUIRED TORQUE** (FtLbs) **LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN* First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
5/8 x 11	1-1/16"	0.226	105,000	14,238	97	89	111	125	133	140	178	267	133	40	80	133
3/4 x 10	1-1/4"	0.334	105,000	21,060	143	132	165	184	197	207	263	395	197	59	118	197
7/8 x 9	1-7/16"	0.461	105,000	29,074	231	212	265	297	318	333	424	636	318	95	191	318
1x 8	1-5/8"	0.605	105,000	38,143	346	318	397	445	477	499	636	954	477	143	286	477
1-1/8 x 8	1-13/16"	0.790	105,000	49,773	509	467	583	653	700	733	933	1,400	700	210	420	700
1-1/4 x 8	2"	0.999	105,000	62,949	715	656	820	918	984	1,029	1,311	1,967	984	295	590	984
1-3/8 x 8	2-3/16"	1.233	105,000	77,671	970	890	1,112	1,246	1,335	1,397	1,780	2,670	1,335	400	801	1335
1-1/2 x 8	2-3/8"	1.491	105,000	93,938	1,280	1,174	1,468	1,644	1,761	1,844	2,348	3,523	1,761	528	1057	1761
1-5/8 x 8	2-9/16"	1.774	105,000	111,751	1,649	1,513	1,892	2,119	2,270	2,376	3,027	4,540	2,270	681	1362	2270
1-3/4 x 8	2-3/4"	2.081	105,000	131,109	2,084	1,912	2,390	2,677	2,868	3,002	3,824	5,736	2,868	860	1721	2868
1-7/8 x 8	2-15/16"	2.413	105,000	152,013	2,589	2,375	2,969	3,325	3,563	3,729	4,750	7,126	3,563	1069	2138	3563
2 x 8	3-1/8"	2.769	105,000	174,462	3,169	2,908	3,635	4,071	4,362	4,565	5,815	8,723	4,362	1308	2617	4362
2-1/8 x 8	3-5/16"	3.150	105,000	198,456	3,831	3,514	4,393	4,920	5,271	5,517	7,029	10,543	5,271	1581	3163	5271
2-1/4 x 8	3-1/2"	3.555	105,000	223,996	4,578	4,200	5,250	5,880	6,300	6,594	8,400	12,600	6,300	1890	3780	6300
2-3/8 x 8	3-11/16"	3.985	105,000	251,081	5,417	4,969	6,212	6,957	7,454	7,802	9,939	14,908	7,454	2236	4472	7454
2-1/2 x 8	3-7/8"	4.440	95,000	253,073	5,747	5,272	6,590	7,381	7,909	8,278	10,545	15,817	7,909	2373	4745	7909
2-3/4 x 8	4-1/4"	5.422	95,000	309,076	7,720	7,083	8,854	9,916	10,624	11,120	14,166	21,249	10,624	3187	6375	10624
3 x 8	4-5/8"	6.503	95,000	370,672	10,101	9,267	11,584	12,974	13,900	14,549	18,534	27,800	13,900	4170	8340	13900
3-1/4 x 8	5"	7.682	95,000	437,862	12,926	11,859	14,823	16,602	17,788	18,618	23,718	35,576	17,788	5336	10673	17788
3-1/2 x 8	5-3/8"	8.959	95,000	510,644	16,234	14,894	18,617	20,851	22,341	23,383	29,788	44,681	22,341	6702	13404	22341
3-3/4 x 8	5-3/4"	10.334	95,000	589,020	20,063	18,407	23,009	25,770	27,610	28,899	36,814	55,221	27,610	8283	16566	27610
4 x 8	6-1/8"	11.807	95,000	672,989	24,452	22,433	28,041	31,406	33,649	35,220	44,866	67,299	33,649	10095	20190	33649
4-1/4 x 8	6-1/2"	13.378	75,000	602,014	23,240	21,321	26,652	29,850	31,982	33,474	42,643	63,964	31,982	9595	19189	31982
4-1/2 x 8	6-7/8"	15.047	75,000	677,136	27,678	25,393	31,741	35,550	38,089	39,866	50,785	76,178	38,089	11427	22853	38089
4-3/4 x 8	7-1/4"	16.815	75,000	756,674	32,647	29,952	37,440	41,932	44,928	47,024	59,903	89,855	44,928	13478	26957	44928
5 x 8	7-5/8"	18.681	75,000	840,628	38,178	35,026	43,783	49,037	52,539	54,991	70,052	105,078	52,539	15762	31524	52539
5-1/4 x 8	8"	20.644	75,000	928,997	44,302	40,644	50,805	56,901	60,965	63,810	81,287	121,931	60,965	18290	36579	60965
5-1/2 x 8	8-3/8"	22.706	75,000	1,021,782	51,047	46,832	58,540	65,564	70,247	73,526	93,663	140,495	70,247	21074	42148	70247
5-3/4 x 8	8-3/4"	24.866	75,000	1,118,982	58,444	53,618	67,022	75,065	80,427	84,180	107,236	160,854	80,427	24128	48256	80427
6 x 8	9-1/8"	27.124	75,000	1,220,598	66,523	61,030	76,287	85,442	91,545	95,817	122,060	183,090	91,545	27463	54927	91545

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TORQUE GUIDE FOR ASTM **A193** GRADE **B7** STUD

BOLT TENSION BASED ON 70 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
5/8 x 11	1-1/16"	0.226	105,000	16,611	113	104	130	145	156	163	208	311	156	47	93	156
3/4 x 10	1-1/4"	0.334	105,000	24,570	167	154	192	215	230	241	307	461	230	69	138	230
7/8 x 9	1-7/16"	0.461	105,000	33,920	270	247	309	346	371	388	495	742	371	111	223	371
1x 8	1-5/8"	0.605	105,000	44,500	404	371	464	519	556	582	742	1,112	556	167	334	556
1-1/8 x 8	1-13/16"	0.790	105,000	58,069	593	544	680	762	817	855	1,089	1,633	817	245	490	817
1-1/4 x 8	2"	0.999	105,000	73,441	834	765	956	1,071	1,148	1,201	1,530	2,295	1,148	344	689	1148
1-3/8 x 8	2-3/16"	1.233	105,000	90,616	1,132	1,038	1,298	1,454	1,557	1,630	2,077	3,115	1,557	467	934	1557
1-1/2 x 8	2-3/8"	1.491	105,000	109,595	1,493	1,370	1,712	1,918	2,055	2,151	2,740	4,110	2,055	616	1233	2055
1-5/8 x 8	2-9/16"	1.774	105,000	130,376	1,924	1,766	2,207	2,472	2,648	2,772	3,531	5,297	2,648	794	1589	2648
1-3/4 x 8	2-3/4"	2.081	105,000	152,960	2,431	2,231	2,788	3,123	3,346	3,502	4,461	6,692	3,346	1004	2008	3346
1-7/8 x 8	2-15/16"	2.413	105,000	177,348	3,020	2,771	3,464	3,879	4,157	4,351	5,542	8,313	4,157	1247	2494	4157
2 x 8	3-1/8"	2.769	105,000	203,538	3,698	3,392	4,240	4,749	5,088	5,326	6,785	10,177	5,088	1527	3053	5088
2-1/8 x 8	3-5/16"	3.150	105,000	231,532	4,469	4,100	5,125	5,740	6,150	6,437	8,200	12,300	6,150	1845	3690	6150
2-1/4 x 8	3-1/2"	3.555	105,000	261,329	5,341	4,900	6,125	6,860	7,350	7,693	9,800	14,700	7,350	2205	4410	7350
2-3/8 x 8	3-11/16"	3.985	105,000	292,928	6,319	5,798	7,247	8,117	8,696	9,102	11,595	17,393	8,696	2609	5218	8696
2-1/2 x 8	3-7/8"	4.440	95,000	295,252	6,705	6,151	7,689	8,612	9,227	9,657	12,302	18,453	9,227	2768	5536	9227
2-3/4 x 8	4-1/4"	5.422	95,000	360,589	9,007	8,263	10,329	11,569	12,395	12,974	16,527	24,790	12,395	3719	7437	12395
3 x 8	4-5/8"	6.503	95,000	432,451	11,784	10,811	13,514	15,136	16,217	16,974	21,623	32,434	16,217	4865	9730	16217
3-1/4 x 8	5"	7.682	95,000	510,839	15,080	13,835	17,294	19,369	20,753	21,721	27,670	41,506	20,753	6226	12452	20753
3-1/2 x 8	5-3/8"	8.959	95,000	595,752	18,940	17,376	21,720	24,327	26,064	27,280	34,752	52,128	26,064	7819	15638	26064
3-3/4 x 8	5-3/4"	10.334	95,000	687,190	23,407	21,475	26,843	30,065	32,212	33,715	42,949	64,424	32,212	9664	19327	32212
4 x 8	6-1/8"	11.807	95,000	785,153	28,527	26,172	32,715	36,640	39,258	41,090	52,344	78,515	39,258	11777	23555	39258
4-1/4 x 8	6-1/2"	13.378	75,000	702,349	27,114	24,875	31,094	34,825	37,312	39,054	49,750	74,625	37,312	11194	22387	37312
4-1/2 x 8	6-7/8"	15.047	75,000	789,992	32,291	29,625	37,031	41,475	44,437	46,511	59,249	88,874	44,437	13331	26662	44437
4-3/4 x 8	7-1/4"	16.815	75,000	882,786	38,089	34,944	43,680	48,921	52,415	54,861	69,887	104,831	52,415	15725	31449	52415
5 x 8	7-5/8"	18.681	75,000	980,732	44,542	40,864	51,080	57,209	61,296	64,156	81,728	122,592	61,296	18389	36777	61296
5-1/4 x 8	8"	20.644	75,000	1,083,830	51,685	47,418	59,272	66,385	71,126	74,446	94,835	142,253	71,126	21338	42676	71126
5-1/2 x 8	8-3/8"	22.706	75,000	1,192,079	59,554	54,637	68,296	76,492	81,955	85,780	109,274	163,911	81,955	24587	49173	81955
5-3/4 x 8	8-3/4"	24.866	75,000	1,305,479	68,184	62,554	78,193	87,576	93,831	98,210	125,108	187,663	93,831	28149	56299	93831
6 x 8	9-1/8"	27.124	75,000	1,424,031	77,610	71,202	89,002	99,682	106,802	111,786	142,403	213,605	106,802	32041	64081	106802

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

REV 7.31.09

This spread sheet is to be used as a guide. all results should be analyzed against actual field results to establish their validity.
To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
If 'K' factor is not listed, Enter appropriate value under Custom (insert K) , in yellow field only
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HYTORC

TORQUE GUIDE FOR ASTM **A193** GRADE **B7** STUD BOLT TENSION BASED ON 80 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
5/8 x 11	1-1/16"	0.226	105,000	18,984	129	119	148	166	178	186	237	356	178	53	107	178
3/4 x 10	1-1/4"	0.334	105,000	28,080	191	176	219	246	263	276	351	527	263	79	158	263
7/8 x 9	1-7/16"	0.461	105,000	38,766	308	283	353	396	424	444	565	848	424	127	254	424
1x 8	1-5/8"	0.605	105,000	50,857	462	424	530	593	636	665	848	1,271	636	191	381	636
1-1/8 x 8	1-13/16"	0.790	105,000	66,364	678	622	778	871	933	977	1,244	1,866	933	280	560	933
1-1/4 x 8	2"	0.999	105,000	83,933	953	874	1,093	1,224	1,311	1,373	1,749	2,623	1,311	393	787	1311
1-3/8 x 8	2-3/16"	1.233	105,000	103,562	1,293	1,187	1,483	1,661	1,780	1,863	2,373	3,560	1,780	534	1068	1780
1-1/2 x 8	2-3/8"	1.491	105,000	125,251	1,707	1,566	1,957	2,192	2,348	2,458	3,131	4,697	2,348	705	1409	2348
1-5/8 x 8	2-9/16"	1.774	105,000	149,001	2,199	2,018	2,522	2,825	3,027	3,168	4,035	6,053	3,027	908	1816	3027
1-3/4 x 8	2-3/4"	2.081	105,000	174,812	2,779	2,549	3,187	3,569	3,824	4,002	5,099	7,648	3,824	1147	2294	3824
1-7/8 x 8	2-15/16"	2.413	105,000	202,683	3,452	3,167	3,959	4,434	4,750	4,972	6,334	9,501	4,750	1425	2850	4750
2 x 8	3-1/8"	2.769	105,000	232,615	4,226	3,877	4,846	5,428	5,815	6,087	7,754	11,631	5,815	1745	3489	5815
2-1/8 x 8	3-5/16"	3.150	105,000	264,608	5,107	4,686	5,857	6,560	7,029	7,357	9,372	14,057	7,029	2109	4217	7029
2-1/4 x 8	3-1/2"	3.555	105,000	298,661	6,104	5,600	7,000	7,840	8,400	8,792	11,200	16,800	8,400	2520	5040	8400
2-3/8 x 8	3-11/16"	3.985	105,000	334,775	7,222	6,626	8,282	9,276	9,939	10,402	13,252	19,877	9,939	2982	5963	9939
2-1/2 x 8	3-7/8"	4.440	95,000	337,431	7,662	7,030	8,787	9,842	10,545	11,037	14,060	21,089	10,545	3163	6327	10545
2-3/4 x 8	4-1/4"	5.422	95,000	412,102	10,294	9,444	11,805	13,222	14,166	14,827	18,888	28,332	14,166	4250	8500	14166
3 x 8	4-5/8"	6.503	95,000	494,230	13,468	12,356	15,445	17,298	18,534	19,399	24,711	37,067	18,534	5560	11120	18534
3-1/4 x 8	5"	7.682	95,000	583,816	17,235	15,812	19,765	22,136	23,718	24,824	31,623	47,435	23,718	7115	14231	23718
3-1/2 x 8	5-3/8"	8.959	95,000	680,859	21,646	19,858	24,823	27,802	29,788	31,178	39,717	59,575	29,788	8936	17873	29788
3-3/4 x 8	5-3/4"	10.334	95,000	785,360	26,751	24,542	30,678	34,359	36,814	38,532	49,085	73,627	36,814	11044	22088	36814
4 x 8	6-1/8"	11.807	95,000	897,318	32,603	29,911	37,388	41,875	44,866	46,960	59,821	89,732	44,866	13460	26920	44866
4-1/4 x 8	6-1/2"	13.378	75,000	802,685	30,987	28,428	35,536	39,800	42,643	44,633	56,857	85,285	42,643	12793	25586	42643
4-1/2 x 8	6-7/8"	15.047	75,000	902,848	36,904	33,857	42,321	47,400	50,785	53,155	67,714	101,570	50,785	15236	30471	50785
4-3/4 x 8	7-1/4"	16.815	75,000	1,008,899	43,530	39,936	49,919	55,910	59,903	62,699	79,871	119,807	59,903	17971	35942	59903
5 x 8	7-5/8"	18.681	75,000	1,120,837	50,905	46,702	58,377	65,382	70,052	73,321	93,403	140,105	70,052	21016	42031	70052
5-1/4 x 8	8"	20.644	75,000	1,238,662	59,069	54,191	67,739	75,868	81,287	85,081	108,383	162,574	81,287	24386	48772	81287
5-1/2 x 8	8-3/8"	22.706	75,000	1,362,375	68,062	62,442	78,053	87,419	93,663	98,034	124,884	187,327	93,663	28099	56198	93663
5-3/4 x 8	8-3/4"	24.866	75,000	1,491,976	77,925	71,491	89,363	100,087	107,236	112,240	142,981	214,472	107,236	32171	64341	107236
6 x 8	9-1/8"	27.124	75,000	1,627,464	88,697	81,373	101,717	113,923	122,060	127,756	162,746	244,120	122,060	36618	73236	122060

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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HYTORC

TORQUE GUIDE FOR ASTM **A193** GRADE **B7** STUD BOLT TENSION BASED ON 90 % YIELD					REQUIRED TORQUE (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
5/8 x 11	1-1/16"	0.226	105,000	21,357	145	133	167	187	200	210	267	400	200	60	120	200
3/4 x 10	1-1/4"	0.334	105,000	31,590	215	197	247	276	296	310	395	592	296	89	178	296
7/8 x 9	1-7/16"	0.461	105,000	43,612	347	318	398	445	477	499	636	954	477	143	286	477
1x 8	1-5/8"	0.605	105,000	57,214	520	477	596	667	715	749	954	1,430	715	215	429	715
1-1/8 x 8	1-13/16"	0.790	105,000	74,660	763	700	875	980	1,050	1,099	1,400	2,100	1,050	315	630	1050
1-1/4 x 8	2"	0.999	105,000	94,424	1,072	984	1,229	1,377	1,475	1,544	1,967	2,951	1,475	443	885	1475
1-3/8 x 8	2-3/16"	1.233	105,000	116,507	1,455	1,335	1,669	1,869	2,002	2,096	2,670	4,005	2,002	601	1201	2002
1-1/2 x 8	2-3/8"	1.491	105,000	140,907	1,920	1,761	2,202	2,466	2,642	2,765	3,523	5,284	2,642	793	1585	2642
1-5/8 x 8	2-9/16"	1.774	105,000	167,626	2,474	2,270	2,837	3,178	3,405	3,564	4,540	6,810	3,405	1021	2043	3405
1-3/4 x 8	2-3/4"	2.081	105,000	196,663	3,126	2,868	3,585	4,015	4,302	4,503	5,736	8,604	4,302	1291	2581	4302
1-7/8 x 8	2-15/16"	2.413	105,000	228,019	3,883	3,563	4,453	4,988	5,344	5,594	7,126	10,688	5,344	1603	3207	5344
2 x 8	3-1/8"	2.769	105,000	261,692	4,754	4,362	5,452	6,106	6,542	6,848	8,723	13,085	6,542	1963	3925	6542
2-1/8 x 8	3-5/16"	3.150	105,000	297,684	5,746	5,271	6,589	7,380	7,907	8,276	10,543	15,814	7,907	2372	4744	7907
2-1/4 x 8	3-1/2"	3.555	105,000	335,994	6,867	6,300	7,875	8,820	9,450	9,891	12,600	18,900	9,450	2835	5670	9450
2-3/8 x 8	3-11/16"	3.985	105,000	376,622	8,125	7,454	9,317	10,436	11,181	11,703	14,908	22,362	11,181	3354	6709	11181
2-1/2 x 8	3-7/8"	4.440	95,000	379,610	8,620	7,909	9,886	11,072	11,863	12,416	15,817	23,726	11,863	3559	7118	11863
2-3/4 x 8	4-1/4"	5.422	95,000	463,614	11,581	10,624	13,281	14,874	15,937	16,680	21,249	31,873	15,937	4781	9562	15937
3 x 8	4-5/8"	6.503	95,000	556,009	15,151	13,900	17,375	19,460	20,850	21,823	27,800	41,701	20,850	6255	12510	20850
3-1/4 x 8	5"	7.682	95,000	656,793	19,389	17,788	22,235	24,903	26,682	27,927	35,576	53,364	26,682	8005	16009	26682
3-1/2 x 8	5-3/8"	8.959	95,000	765,966	24,351	22,341	27,926	31,277	33,511	35,075	44,681	67,022	33,511	10053	20107	33511
3-3/4 x 8	5-3/4"	10.334	95,000	883,530	30,095	27,610	34,513	38,654	41,415	43,348	55,221	82,831	41,415	12425	24849	41415
4 x 8	6-1/8"	11.807	95,000	1,009,483	36,678	33,649	42,062	47,109	50,474	52,830	67,299	100,948	50,474	15142	30284	50474
4-1/4 x 8	6-1/2"	13.378	75,000	903,020	34,860	31,982	39,977	44,775	47,973	50,212	63,964	95,946	47,973	14392	28784	47973
4-1/2 x 8	6-7/8"	15.047	75,000	1,015,704	41,517	38,089	47,611	53,324	57,133	59,800	76,178	114,267	57,133	17140	34280	57133
4-3/4 x 8	7-1/4"	16.815	75,000	1,135,011	48,971	44,928	56,159	62,899	67,391	70,536	89,855	134,783	67,391	20217	40435	67391
5 x 8	7-5/8"	18.681	75,000	1,260,941	57,268	52,539	65,674	73,555	78,809	82,487	105,078	157,618	78,809	23643	47285	78809
5-1/4 x 8	8"	20.644	75,000	1,393,495	66,452	60,965	76,207	85,352	91,448	95,716	121,931	182,896	91,448	27434	54869	91448
5-1/2 x 8	8-3/8"	22.706	75,000	1,532,672	76,570	70,247	87,809	98,346	105,371	110,289	140,495	210,742	105,371	31611	63223	105371
5-3/4 x 8	8-3/4"	24.866	75,000	1,678,473	87,665	80,427	100,534	112,598	120,640	126,270	160,854	241,281	120,640	36192	72384	120640
6 x 8	9-1/8"	27.124	75,000	1,830,897	99,784	91,545	114,431	128,163	137,317	143,725	183,090	274,635	137,317	41195	82390	137317

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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Enter the desired percent yield in yellow field at top of form
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TORQUE GUIDE FOR ASTM **A193** GRADE **B7** STUD

BOLT TENSION BASED ON 99 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
5/8 x 11	1-1/16"	0.226	105,000	23,493	160	147	184	206	220	231	294	440	220	66	132	220
3/4 x 10	1-1/4"	0.334	105,000	34,749	237	217	271	304	326	341	434	652	326	98	195	326
7/8 x 9	1-7/16"	0.461	105,000	47,973	381	350	437	490	525	549	700	1,049	525	157	315	525
1x 8	1-5/8"	0.605	105,000	62,935	572	524	656	734	787	823	1,049	1,573	787	236	472	787
1-1/8 x 8	1-13/16"	0.790	105,000	82,126	839	770	962	1,078	1,155	1,209	1,540	2,310	1,155	346	693	1155
1-1/4 x 8	2"	0.999	105,000	103,867	1,179	1,082	1,352	1,515	1,623	1,699	2,164	3,246	1,623	487	974	1623
1-3/8 x 8	2-3/16"	1.233	105,000	128,157	1,601	1,468	1,836	2,056	2,203	2,305	2,937	4,405	2,203	661	1322	2203
1-1/2 x 8	2-3/8"	1.491	105,000	154,998	2,112	1,937	2,422	2,712	2,906	3,042	3,875	5,812	2,906	872	1744	2906
1-5/8 x 8	2-9/16"	1.774	105,000	184,389	2,722	2,497	3,121	3,496	3,745	3,920	4,994	7,491	3,745	1124	2247	3745
1-3/4 x 8	2-3/4"	2.081	105,000	216,330	3,439	3,155	3,944	4,417	4,732	4,953	6,310	9,464	4,732	1420	2839	4732
1-7/8 x 8	2-15/16"	2.413	105,000	250,821	4,272	3,919	4,899	5,487	5,879	6,153	7,838	11,757	5,879	1764	3527	5879
2 x 8	3-1/8"	2.769	105,000	287,862	5,229	4,798	5,997	6,717	7,197	7,532	9,595	14,393	7,197	2159	4318	7197
2-1/8 x 8	3-5/16"	3.150	105,000	327,452	6,321	5,799	7,248	8,118	8,698	9,104	11,597	17,396	8,698	2609	5219	8698
2-1/4 x 8	3-1/2"	3.555	105,000	369,593	7,554	6,930	8,662	9,702	10,395	10,880	13,860	20,790	10,395	3118	6237	10395
2-3/8 x 8	3-11/16"	3.985	105,000	414,284	8,937	8,199	10,249	11,479	12,299	12,873	16,399	24,598	12,299	3690	7379	12299
2-1/2 x 8	3-7/8"	4.440	95,000	417,570	9,482	8,699	10,874	12,179	13,049	13,658	17,399	26,098	13,049	3915	7829	13049
2-3/4 x 8	4-1/4"	5.422	95,000	509,976	12,739	11,687	14,609	16,362	17,530	18,348	23,374	35,061	17,530	5259	10518	17530
3 x 8	4-5/8"	6.503	95,000	611,609	16,666	15,290	19,113	21,406	22,935	24,006	30,580	45,871	22,935	6881	13761	22935
3-1/4 x 8	5"	7.682	95,000	722,472	21,328	19,567	24,459	27,394	29,350	30,720	39,134	58,701	29,350	8805	17610	29350
3-1/2 x 8	5-3/8"	8.959	95,000	842,563	26,786	24,575	30,718	34,405	36,862	38,582	49,150	73,724	36,862	11059	22117	36862
3-3/4 x 8	5-3/4"	10.334	95,000	971,883	33,105	30,371	37,964	42,520	45,557	47,683	60,743	91,114	45,557	13667	27334	45557
4 x 8	6-1/8"	11.807	95,000	1,110,431	40,346	37,014	46,268	51,820	55,522	58,113	74,029	111,043	55,522	16656	33313	55522
4-1/4 x 8	6-1/2"	13.378	75,000	993,322	38,346	35,180	43,975	49,252	52,770	55,233	70,360	105,540	52,770	15831	31662	52770
4-1/2 x 8	6-7/8"	15.047	75,000	1,117,274	45,669	41,898	52,372	58,657	62,847	65,780	83,796	125,693	62,847	18854	37708	62847
4-3/4 x 8	7-1/4"	16.815	75,000	1,248,512	53,868	49,420	61,775	69,188	74,130	77,590	98,841	148,261	74,130	22239	44478	74130
5 x 8	7-5/8"	18.681	75,000	1,387,035	62,995	57,793	72,241	80,910	86,690	90,735	115,586	173,379	86,690	26007	52014	86690
5-1/4 x 8	8"	20.644	75,000	1,532,845	73,098	67,062	83,827	93,887	100,593	105,287	134,124	201,186	100,593	30178	60356	100593
5-1/2 x 8	8-3/8"	22.706	75,000	1,685,940	84,227	77,272	96,590	108,181	115,908	121,317	154,544	231,817	115,908	34773	69545	115908
5-3/4 x 8	8-3/4"	24.866	75,000	1,846,320	96,432	88,470	110,587	123,857	132,704	138,897	176,939	265,409	132,704	39811	79623	132704
6 x 8	9-1/8"	27.124	75,000	2,013,987	109,762	100,699	125,874	140,979	151,049	158,098	201,399	302,098	151,049	45315	90629	151049

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
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HYTORC

TORQUE GUIDE FOR ASTM **A193** GRADE **B7M**

BOLT TENSION BASED ON 40 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	80,000	10,697	73	67	84	94	100	105	134	201	100	30	60	100
7/8 x 9	1-7/16"	0.461	80,000	14,768	117	108	135	151	162	169	215	323	162	48	97	162
1x 8	1-5/8"	0.605	80,000	19,374	176	161	202	226	242	253	323	484	242	73	145	242
1-1/8 x 8	1-13/16"	0.790	80,000	25,282	258	237	296	332	356	372	474	711	356	107	213	356
1-1/4 x 8	2"	0.999	80,000	31,974	363	333	416	466	500	523	666	999	500	150	300	500
1-3/8 x 8	2-3/16"	1.233	80,000	39,452	493	452	565	633	678	710	904	1,356	678	203	407	678
1-1/2 x 8	2-3/8"	1.491	80,000	47,715	650	596	746	835	895	936	1,193	1,789	895	268	537	895
1-5/8 x 8	2-9/16"	1.774	80,000	56,762	838	769	961	1,076	1,153	1,207	1,537	2,306	1,153	346	692	1153
1-3/4 x 8	2-3/4"	2.081	80,000	66,595	1,059	971	1,214	1,360	1,457	1,525	1,942	2,914	1,457	437	874	1457
1-7/8 x 8	2-15/16"	2.413	80,000	77,213	1,315	1,206	1,508	1,689	1,810	1,894	2,413	3,619	1,810	543	1086	1810
2 x 8	3-1/8"	2.769	80,000	88,615	1,610	1,477	1,846	2,068	2,215	2,319	2,954	4,431	2,215	665	1329	2215
2-1/8 x 8	3-5/16"	3.150	80,000	100,803	1,946	1,785	2,231	2,499	2,678	2,803	3,570	5,355	2,678	803	1607	2678
2-1/4 x 8	3-1/2"	3.555	80,000	113,776	2,325	2,133	2,667	2,987	3,200	3,349	4,267	6,400	3,200	960	1920	3200
2-3/8 x 8	3-11/16"	3.985	80,000	127,533	2,751	2,524	3,155	3,534	3,786	3,963	5,048	7,572	3,786	1136	2272	3786
2-1/2 x 8	3-7/8"	4.440	80,000	142,076	3,226	2,960	3,700	4,144	4,440	4,647	5,920	8,880	4,440	1332	2664	4440

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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Enter the desired percent yield in yellow field at top of form
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TORQUE GUIDE FOR ASTM **A193** GRADE **B7M** BOLT TENSION BASED ON 50 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	80,000	13,372	91	84	104	117	125	131	167	251	125	38	75	125
7/8 x 9	1-7/16"	0.461	80,000	18,460	147	135	168	188	202	211	269	404	202	61	121	202
1x 8	1-5/8"	0.605	80,000	24,217	220	202	252	283	303	317	404	605	303	91	182	303
1-1/8 x 8	1-13/16"	0.790	80,000	31,602	323	296	370	415	444	465	593	889	444	133	267	444
1-1/4 x 8	2"	0.999	80,000	39,968	454	416	520	583	624	654	833	1,249	624	187	375	624
1-3/8 x 8	2-3/16"	1.233	80,000	49,315	616	565	706	791	848	887	1,130	1,695	848	254	509	848
1-1/2 x 8	2-3/8"	1.491	80,000	59,643	813	746	932	1,044	1,118	1,171	1,491	2,237	1,118	335	671	1118
1-5/8 x 8	2-9/16"	1.774	80,000	70,953	1,047	961	1,201	1,345	1,441	1,508	1,922	2,882	1,441	432	865	1441
1-3/4 x 8	2-3/4"	2.081	80,000	83,244	1,323	1,214	1,517	1,700	1,821	1,906	2,428	3,642	1,821	546	1093	1821
1-7/8 x 8	2-15/16"	2.413	80,000	96,516	1,644	1,508	1,885	2,111	2,262	2,368	3,016	4,524	2,262	679	1357	2262
2 x 8	3-1/8"	2.769	80,000	110,769	2,012	1,846	2,308	2,585	2,769	2,898	3,692	5,538	2,769	831	1662	2769
2-1/8 x 8	3-5/16"	3.150	80,000	126,004	2,432	2,231	2,789	3,124	3,347	3,503	4,463	6,694	3,347	1004	2008	3347
2-1/4 x 8	3-1/2"	3.555	80,000	142,220	2,907	2,667	3,333	3,733	4,000	4,187	5,333	8,000	4,000	1200	2400	4000
2-3/8 x 8	3-11/16"	3.985	80,000	159,417	3,439	3,155	3,944	4,417	4,733	4,954	6,310	9,465	4,733	1420	2840	4733
2-1/2 x 8	3-7/8"	4.440	80,000	177,595	4,033	3,700	4,625	5,180	5,550	5,809	7,400	11,100	5,550	1665	3330	5550

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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TORQUE GUIDE FOR ASTM **A193** GRADE **B7M**

BOLT TENSION BASED ON 60 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	80,000	16,046	109	100	125	140	150	157	201	301	150	45	90	150
7/8 x 9	1-7/16"	0.461	80,000	22,152	176	162	202	226	242	254	323	485	242	73	145	242
1x 8	1-5/8"	0.605	80,000	29,061	264	242	303	339	363	380	484	727	363	109	218	363
1-1/8 x 8	1-13/16"	0.790	80,000	37,922	388	356	444	498	533	558	711	1,067	533	160	320	533
1-1/4 x 8	2"	0.999	80,000	47,961	545	500	624	699	749	784	999	1,499	749	225	450	749
1-3/8 x 8	2-3/16"	1.233	80,000	59,178	739	678	848	949	1,017	1,065	1,356	2,034	1,017	305	610	1017
1-1/2 x 8	2-3/8"	1.491	80,000	71,572	975	895	1,118	1,253	1,342	1,405	1,789	2,684	1,342	403	805	1342
1-5/8 x 8	2-9/16"	1.774	80,000	85,144	1,257	1,153	1,441	1,614	1,729	1,810	2,306	3,459	1,729	519	1038	1729
1-3/4 x 8	2-3/4"	2.081	80,000	99,893	1,588	1,457	1,821	2,039	2,185	2,287	2,914	4,370	2,185	656	1311	2185
1-7/8 x 8	2-15/16"	2.413	80,000	115,819	1,973	1,810	2,262	2,534	2,715	2,841	3,619	5,429	2,715	814	1629	2715
2 x 8	3-1/8"	2.769	80,000	132,923	2,415	2,215	2,769	3,102	3,323	3,478	4,431	6,646	3,323	997	1994	3323
2-1/8 x 8	3-5/16"	3.150	80,000	151,205	2,919	2,678	3,347	3,749	4,016	4,204	5,355	8,033	4,016	1205	2410	4016
2-1/4 x 8	3-1/2"	3.555	80,000	170,664	3,488	3,200	4,000	4,480	4,800	5,024	6,400	9,600	4,800	1440	2880	4800
2-3/8 x 8	3-11/16"	3.985	80,000	191,300	4,127	3,786	4,733	5,301	5,679	5,944	7,572	11,358	5,679	1704	3408	5679
2-1/2 x 8	3-7/8"	4.440	80,000	213,114	4,839	4,440	5,550	6,216	6,660	6,971	8,880	13,320	6,660	1998	3996	6660

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TORQUE GUIDE FOR ASTM **A193** GRADE **B7M**

BOLT TENSION BASED ON 70 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	80,000	18,720	128	117	146	164	176	184	234	351	176	53	105	176
7/8 x 9	1-7/16"	0.461	80,000	25,844	205	188	236	264	283	296	377	565	283	85	170	283
1x 8	1-5/8"	0.605	80,000	33,904	308	283	353	396	424	444	565	848	424	127	254	424
1-1/8 x 8	1-13/16"	0.790	80,000	44,243	452	415	518	581	622	651	830	1,244	622	187	373	622
1-1/4 x 8	2"	0.999	80,000	55,955	635	583	729	816	874	915	1,166	1,749	874	262	525	874
1-3/8 x 8	2-3/16"	1.233	80,000	69,041	862	791	989	1,108	1,187	1,242	1,582	2,373	1,187	356	712	1187
1-1/2 x 8	2-3/8"	1.491	80,000	83,501	1,138	1,044	1,305	1,461	1,566	1,639	2,088	3,131	1,566	470	939	1566
1-5/8 x 8	2-9/16"	1.774	80,000	99,334	1,466	1,345	1,681	1,883	2,018	2,112	2,690	4,035	2,018	605	1211	2018
1-3/4 x 8	2-3/4"	2.081	80,000	116,541	1,853	1,700	2,124	2,379	2,549	2,668	3,399	5,099	2,549	765	1530	2549
1-7/8 x 8	2-15/16"	2.413	80,000	135,122	2,301	2,111	2,639	2,956	3,167	3,315	4,223	6,334	3,167	950	1900	3167
2 x 8	3-1/8"	2.769	80,000	155,077	2,817	2,585	3,231	3,618	3,877	4,058	5,169	7,754	3,877	1163	2326	3877
2-1/8 x 8	3-5/16"	3.150	80,000	176,405	3,405	3,124	3,905	4,373	4,686	4,904	6,248	9,372	4,686	1406	2811	4686
2-1/4 x 8	3-1/2"	3.555	80,000	199,108	4,069	3,733	4,667	5,227	5,600	5,861	7,467	11,200	5,600	1680	3360	5600
2-3/8 x 8	3-11/16"	3.985	80,000	223,183	4,815	4,417	5,521	6,184	6,626	6,935	8,834	13,252	6,626	1988	3975	6626
2-1/2 x 8	3-7/8"	4.440	80,000	248,633	5,646	5,180	6,475	7,252	7,770	8,132	10,360	15,540	7,770	2331	4662	7770

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TORQUE GUIDE FOR ASTM **A193** GRADE **B7M**

BOLT TENSION BASED ON 80 % YIELD

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
					REQUIRED TORQUE (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
3/4 x 10	1-1/4"	0.334	80,000	21,395	146	134	167	187	201	210	267	401	201	60	120	201
7/8 x 9	1-7/16"	0.461	80,000	29,536	235	215	269	302	323	338	431	646	323	97	194	323
1x 8	1-5/8"	0.605	80,000	38,748	352	323	404	452	484	507	646	969	484	145	291	484
1-1/8 x 8	1-13/16"	0.790	80,000	50,563	517	474	593	664	711	744	948	1,422	711	213	427	711
1-1/4 x 8	2"	0.999	80,000	63,949	726	666	833	933	999	1,046	1,332	1,998	999	300	600	999
1-3/8 x 8	2-3/16"	1.233	80,000	78,904	985	904	1,130	1,266	1,356	1,419	1,808	2,712	1,356	407	814	1356
1-1/2 x 8	2-3/8"	1.491	80,000	95,429	1,300	1,193	1,491	1,670	1,789	1,873	2,386	3,579	1,789	537	1074	1789
1-5/8 x 8	2-9/16"	1.774	80,000	113,525	1,676	1,537	1,922	2,152	2,306	2,414	3,075	4,612	2,306	692	1384	2306
1-3/4 x 8	2-3/4"	2.081	80,000	133,190	2,117	1,942	2,428	2,719	2,914	3,049	3,885	5,827	2,914	874	1748	2914
1-7/8 x 8	2-15/16"	2.413	80,000	154,425	2,630	2,413	3,016	3,378	3,619	3,788	4,826	7,239	3,619	1086	2172	3619
2 x 8	3-1/8"	2.769	80,000	177,231	3,220	2,954	3,692	4,135	4,431	4,638	5,908	8,862	4,431	1329	2658	4431
2-1/8 x 8	3-5/16"	3.150	80,000	201,606	3,891	3,570	4,463	4,998	5,355	5,605	7,140	10,710	5,355	1607	3213	5355
2-1/4 x 8	3-1/2"	3.555	80,000	227,551	4,651	4,267	5,333	5,973	6,400	6,699	8,533	12,800	6,400	1920	3840	6400
2-3/8 x 8	3-11/16"	3.985	80,000	255,067	5,503	5,048	6,310	7,067	7,572	7,926	10,096	15,145	7,572	2272	4543	7572
2-1/2 x 8	3-7/8"	4.440	80,000	284,152	6,453	5,920	7,400	8,288	8,880	9,294	11,840	17,760	8,880	2664	5328	8880

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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Enter the desired percent yield in yellow field at top of form
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HYTORC

TORQUE GUIDE FOR ASTM **A193** GRADE **B7M**

BOLT TENSION BASED ON 90 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	80,000	24,069	164	150	188	211	226	236	301	451	226	68	135	226
7/8 x 9	1-7/16"	0.461	80,000	33,228	264	242	303	339	363	380	485	727	363	109	218	363
1x 8	1-5/8"	0.605	80,000	43,591	396	363	454	509	545	570	727	1,090	545	163	327	545
1-1/8 x 8	1-13/16"	0.790	80,000	56,884	581	533	667	747	800	837	1,067	1,600	800	240	480	800
1-1/4 x 8	2"	0.999	80,000	71,942	817	749	937	1,049	1,124	1,177	1,499	2,248	1,124	337	674	1124
1-3/8 x 8	2-3/16"	1.233	80,000	88,767	1,109	1,017	1,271	1,424	1,526	1,597	2,034	3,051	1,526	458	915	1526
1-1/2 x 8	2-3/8"	1.491	80,000	107,358	1,463	1,342	1,677	1,879	2,013	2,107	2,684	4,026	2,013	604	1208	2013
1-5/8 x 8	2-9/16"	1.774	80,000	127,715	1,885	1,729	2,162	2,421	2,594	2,715	3,459	5,188	2,594	778	1557	2594
1-3/4 x 8	2-3/4"	2.081	80,000	149,839	2,382	2,185	2,731	3,059	3,278	3,431	4,370	6,555	3,278	983	1967	3278
1-7/8 x 8	2-15/16"	2.413	80,000	173,729	2,959	2,715	3,393	3,800	4,072	4,262	5,429	8,144	4,072	1222	2443	4072
2 x 8	3-1/8"	2.769	80,000	199,385	3,622	3,323	4,154	4,652	4,985	5,217	6,646	9,969	4,985	1495	2991	4985
2-1/8 x 8	3-5/16"	3.150	80,000	226,807	4,378	4,016	5,020	5,623	6,025	6,306	8,033	12,049	6,025	1807	3615	6025
2-1/4 x 8	3-1/2"	3.555	80,000	255,995	5,232	4,800	6,000	6,720	7,200	7,536	9,600	14,400	7,200	2160	4320	7200
2-3/8 x 8	3-11/16"	3.985	80,000	286,950	6,190	5,679	7,099	7,951	8,519	8,916	11,358	17,038	8,519	2556	5111	8519
2-1/2 x 8	3-7/8"	4.440	80,000	319,671	7,259	6,660	8,325	9,324	9,990	10,456	13,320	19,979	9,990	2997	5994	9990

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HYTORC

TORQUE GUIDE FOR ASTM **A193** GRADE **B7M**

BOLT TENSION BASED ON 99 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	80,000	26,476	180	165	207	232	248	260	331	496	248	74	149	248
7/8 x 9	1-7/16"	0.461	80,000	36,551	291	267	333	373	400	418	533	800	400	120	240	400
1x 8	1-5/8"	0.605	80,000	47,951	436	400	499	559	599	627	799	1,199	599	180	360	599
1-1/8 x 8	1-13/16"	0.790	80,000	62,572	639	587	733	821	880	921	1,173	1,760	880	264	528	880
1-1/4 x 8	2"	0.999	80,000	79,136	899	824	1,030	1,154	1,237	1,294	1,649	2,473	1,237	371	742	1237
1-3/8 x 8	2-3/16"	1.233	80,000	97,644	1,220	1,119	1,399	1,566	1,678	1,757	2,238	3,357	1,678	503	1007	1678
1-1/2 x 8	2-3/8"	1.491	80,000	118,094	1,609	1,476	1,845	2,067	2,214	2,318	2,952	4,429	2,214	664	1329	2214
1-5/8 x 8	2-9/16"	1.774	80,000	140,487	2,074	1,902	2,378	2,663	2,854	2,987	3,805	5,707	2,854	856	1712	2854
1-3/4 x 8	2-3/4"	2.081	80,000	164,823	2,620	2,404	3,005	3,365	3,605	3,774	4,807	7,211	3,605	1082	2163	3605
1-7/8 x 8	2-15/16"	2.413	80,000	191,101	3,255	2,986	3,732	4,180	4,479	4,688	5,972	8,958	4,479	1344	2687	4479
2 x 8	3-1/8"	2.769	80,000	219,323	3,984	3,655	4,569	5,118	5,483	5,739	7,311	10,966	5,483	1645	3290	5483
2-1/8 x 8	3-5/16"	3.150	80,000	249,488	4,816	4,418	5,523	6,185	6,627	6,936	8,836	13,254	6,627	1988	3976	6627
2-1/4 x 8	3-1/2"	3.555	80,000	281,595	5,755	5,280	6,600	7,392	7,920	8,289	10,560	15,840	7,920	2376	4752	7920
2-3/8 x 8	3-11/16"	3.985	80,000	315,645	6,809	6,247	7,809	8,746	9,371	9,808	12,494	18,741	9,371	2811	5622	9371
2-1/2 x 8	3-7/8"	4.440	80,000	351,638	7,985	7,326	9,157	10,256	10,989	11,502	14,652	21,977	10,989	3297	6593	10989

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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TORQUE GUIDE FOR ASTM **A193** GRADE **B16** STUD

BOLT TENSION BASED ON 40 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	105,000	14,040	96	88	110	123	132	138	176	263	132	39	79	132
7/8 x 9	1-7/16"	0.461	105,000	19,383	154	141	177	198	212	222	283	424	212	64	127	212
1x 8	1-5/8"	0.605	105,000	25,428	231	212	265	297	318	333	424	636	318	95	191	318
1-1/8 x 8	1-13/16"	0.790	105,000	33,182	339	311	389	436	467	488	622	933	467	140	280	467
1-1/4 x 8	2"	0.999	105,000	41,966	476	437	546	612	656	686	874	1,311	656	197	393	656
1-3/8 x 8	2-3/16"	1.233	105,000	51,781	647	593	742	831	890	932	1,187	1,780	890	267	534	890
1-1/2 x 8	2-3/8"	1.491	105,000	62,626	853	783	979	1,096	1,174	1,229	1,566	2,348	1,174	352	705	1174
1-5/8 x 8	2-9/16"	1.774	105,000	74,501	1,100	1,009	1,261	1,412	1,513	1,584	2,018	3,027	1,513	454	908	1513
1-3/4 x 8	2-3/4"	2.081	105,000	87,406	1,389	1,275	1,593	1,785	1,912	2,001	2,549	3,824	1,912	574	1147	1912
1-7/8 x 8	2-15/16"	2.413	105,000	101,342	1,726	1,583	1,979	2,217	2,375	2,486	3,167	4,750	2,375	713	1425	2375
2 x 8	3-1/8"	2.769	105,000	116,308	2,113	1,938	2,423	2,714	2,908	3,043	3,877	5,815	2,908	872	1745	2908
2-1/8 x 8	3-5/16"	3.150	105,000	132,304	2,554	2,343	2,929	3,280	3,514	3,678	4,686	7,029	3,514	1054	2109	3514
2-1/4 x 8	3-1/2"	3.555	105,000	149,331	3,052	2,800	3,500	3,920	4,200	4,396	5,600	8,400	4,200	1260	2520	4200
2-3/8 x 8	3-11/16"	3.985	105,000	167,388	3,611	3,313	4,141	4,638	4,969	5,201	6,626	9,939	4,969	1491	2982	4969
2-1/2 x 8	3-7/8"	4.440	95,000	168,715	3,831	3,515	4,394	4,921	5,272	5,518	7,030	10,545	5,272	1582	3163	5272
2-3/4 x 8	4-1/4"	5.422	95,000	206,051	5,147	4,722	5,902	6,611	7,083	7,414	9,444	14,166	7,083	2125	4250	7083
3 x 8	4-5/8"	6.503	95,000	247,115	6,734	6,178	7,722	8,649	9,267	9,699	12,356	18,534	9,267	2780	5560	9267
3-1/4 x 8	5"	7.682	95,000	291,908	8,617	7,906	9,882	11,068	11,859	12,412	15,812	23,718	11,859	3558	7115	11859
3-1/2 x 8	5-3/8"	8.959	95,000	340,429	10,823	9,929	12,411	13,901	14,894	15,589	19,858	29,788	14,894	4468	8936	14894
3-3/4 x 8	5-3/4"	10.334	95,000	392,680	13,376	12,271	15,339	17,180	18,407	19,266	24,542	36,814	18,407	5522	11044	18407
4 x 8	6-1/8"	11.807	95,000	448,659	16,301	14,955	18,694	20,937	22,433	23,480	29,911	44,866	22,433	6730	13460	22433
4-1/4 x 8	6-1/2"	13.378	85,000	454,855	17,559	16,109	20,137	22,553	24,164	25,292	32,219	48,328	24,164	7249	14498	24164
4-1/2 x 8	6-7/8"	15.047	85,000	511,614	20,912	19,186	23,982	26,860	28,778	30,121	38,371	57,557	28,778	8633	17267	28778
4-3/4 x 8	7-1/4"	16.815	85,000	571,709	24,667	22,630	28,288	31,682	33,945	35,529	45,260	67,890	33,945	10184	20367	33945
5 x 8	7-5/8"	18.681	85,000	635,141	28,846	26,464	33,080	37,050	39,696	41,549	52,928	79,393	39,696	11909	23818	39696
5-1/4 x 8	8"	20.644	85,000	701,909	33,472	30,709	38,386	42,992	46,063	48,212	61,417	92,126	46,063	13819	27638	46063
5-1/2 x 8	8-3/8"	22.706	85,000	772,013	38,568	35,384	44,230	49,537	53,076	55,553	70,768	106,152	53,076	15923	31846	53076
5-3/4 x 8	8-3/4"	24.866	85,000	845,453	44,157	40,511	50,639	56,716	60,767	63,603	81,023	121,534	60,767	18230	36460	60767
6 x 8	9-1/8"	27.124	85,000	922,230	50,262	46,111	57,639	64,556	69,167	72,395	92,223	138,334	69,167	20750	41500	69167

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TORQUE GUIDE FOR ASTM **A193** GRADE **B16** STUD BOLT TENSION BASED ON 50 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	105,000	17,550	120	110	137	154	165	172	219	329	165	49	99	165
7/8 x 9	1-7/16"	0.461	105,000	24,229	193	177	221	247	265	277	353	530	265	80	159	265
1x 8	1-5/8"	0.605	105,000	31,785	289	265	331	371	397	416	530	795	397	119	238	397
1-1/8 x 8	1-13/16"	0.790	105,000	41,478	424	389	486	544	583	611	778	1,167	583	175	350	583
1-1/4 x 8	2"	0.999	105,000	52,458	596	546	683	765	820	858	1,093	1,639	820	246	492	820
1-3/8 x 8	2-3/16"	1.233	105,000	64,726	808	742	927	1,038	1,112	1,164	1,483	2,225	1,112	334	667	1112
1-1/2 x 8	2-3/8"	1.491	105,000	78,282	1,067	979	1,223	1,370	1,468	1,536	1,957	2,936	1,468	440	881	1468
1-5/8 x 8	2-9/16"	1.774	105,000	93,126	1,375	1,261	1,576	1,766	1,892	1,980	2,522	3,783	1,892	567	1135	1892
1-3/4 x 8	2-3/4"	2.081	105,000	109,257	1,737	1,593	1,992	2,231	2,390	2,502	3,187	4,780	2,390	717	1434	2390
1-7/8 x 8	2-15/16"	2.413	105,000	126,677	2,157	1,979	2,474	2,771	2,969	3,108	3,959	5,938	2,969	891	1781	2969
2 x 8	3-1/8"	2.769	105,000	145,385	2,641	2,423	3,029	3,392	3,635	3,804	4,846	7,269	3,635	1090	2181	3635
2-1/8 x 8	3-5/16"	3.150	105,000	165,380	3,192	2,929	3,661	4,100	4,393	4,598	5,857	8,786	4,393	1318	2636	4393
2-1/4 x 8	3-1/2"	3.555	105,000	186,663	3,815	3,500	4,375	4,900	5,250	5,495	7,000	10,500	5,250	1575	3150	5250
2-3/8 x 8	3-11/16"	3.985	105,000	209,234	4,514	4,141	5,176	5,798	6,212	6,502	8,282	12,423	6,212	1863	3727	6212
2-1/2 x 8	3-7/8"	4.440	95,000	210,894	4,789	4,394	5,492	6,151	6,590	6,898	8,787	13,181	6,590	1977	3954	6590
2-3/4 x 8	4-1/4"	5.422	95,000	257,563	6,434	5,902	7,378	8,263	8,854	9,267	11,805	17,707	8,854	2656	5312	8854
3 x 8	4-5/8"	6.503	95,000	308,894	8,417	7,722	9,653	10,811	11,584	12,124	15,445	23,167	11,584	3475	6950	11584
3-1/4 x 8	5"	7.682	95,000	364,885	10,772	9,882	12,353	13,835	14,823	15,515	19,765	29,647	14,823	4447	8894	14823
3-1/2 x 8	5-3/8"	8.959	95,000	425,537	13,529	12,411	15,514	17,376	18,617	19,486	24,823	37,234	18,617	5585	11170	18617
3-3/4 x 8	5-3/4"	10.334	95,000	490,850	16,720	15,339	19,174	21,475	23,009	24,082	30,678	46,017	23,009	6903	13805	23009
4 x 8	6-1/8"	11.807	95,000	560,824	20,377	18,694	23,368	26,172	28,041	29,350	37,388	56,082	28,041	8412	16825	28041
4-1/4 x 8	6-1/2"	13.378	85,000	568,568	21,949	20,137	25,171	28,192	30,205	31,615	40,274	60,410	30,205	9062	18123	30205
4-1/2 x 8	6-7/8"	15.047	85,000	639,517	26,140	23,982	29,977	33,575	35,973	37,652	47,964	71,946	35,973	10792	21584	35973
4-3/4 x 8	7-1/4"	16.815	85,000	714,636	30,834	28,288	35,360	39,603	42,432	44,412	56,575	84,863	42,432	12729	25459	42432
5 x 8	7-5/8"	18.681	85,000	793,926	36,057	33,080	41,350	46,312	49,620	51,936	66,160	99,241	49,620	14886	29772	49620
5-1/4 x 8	8"	20.644	85,000	877,386	41,840	38,386	47,982	53,740	57,578	60,265	76,771	115,157	57,578	17274	34547	57578
5-1/2 x 8	8-3/8"	22.706	85,000	965,016	48,211	44,230	55,287	61,922	66,345	69,441	88,460	132,690	66,345	19903	39807	66345
5-3/4 x 8	8-3/4"	24.866	85,000	1,056,816	55,197	50,639	63,299	70,895	75,959	79,503	101,278	151,917	75,959	22788	45575	75959
6 x 8	9-1/8"	27.124	85,000	1,152,787	62,827	57,639	72,049	80,695	86,459	90,494	115,279	172,918	86,459	25938	51875	86459

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
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HYTORC

TORQUE GUIDE FOR ASTM **A193** GRADE **B16** STUD

BOLT TENSION BASED ON 60 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN²)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	105,000	21,060	143	132	165	184	197	207	263	395	197	59	118	197
7/8 x 9	1-7/16"	0.461	105,000	29,074	231	212	265	297	318	333	424	636	318	95	191	318
1x 8	1-5/8"	0.605	105,000	38,143	346	318	397	445	477	499	636	954	477	143	286	477
1-1/8 x 8	1-13/16"	0.790	105,000	49,773	509	467	583	653	700	733	933	1,400	700	210	420	700
1-1/4 x 8	2"	0.999	105,000	62,949	715	656	820	918	984	1,029	1,311	1,967	984	295	590	984
1-3/8 x 8	2-3/16"	1.233	105,000	77,671	970	890	1,112	1,246	1,335	1,397	1,780	2,670	1,335	400	801	1335
1-1/2 x 8	2-3/8"	1.491	105,000	93,938	1,280	1,174	1,468	1,644	1,761	1,844	2,348	3,523	1,761	528	1057	1761
1-5/8 x 8	2-9/16"	1.774	105,000	111,751	1,649	1,513	1,892	2,119	2,270	2,376	3,027	4,540	2,270	681	1362	2270
1-3/4 x 8	2-3/4"	2.081	105,000	131,109	2,084	1,912	2,390	2,677	2,868	3,002	3,824	5,736	2,868	860	1721	2868
1-7/8 x 8	2-15/16"	2.413	105,000	152,013	2,589	2,375	2,969	3,325	3,563	3,729	4,750	7,126	3,563	1069	2138	3563
2 x 8	3-1/8"	2.769	105,000	174,462	3,169	2,908	3,635	4,071	4,362	4,565	5,815	8,723	4,362	1308	2617	4362
2-1/8 x 8	3-5/16"	3.150	105,000	198,456	3,831	3,514	4,393	4,920	5,271	5,517	7,029	10,543	5,271	1581	3163	5271
2-1/4 x 8	3-1/2"	3.555	105,000	223,996	4,578	4,200	5,250	5,880	6,300	6,594	8,400	12,600	6,300	1890	3780	6300
2-3/8 x 8	3-11/16"	3.985	105,000	251,081	5,417	4,969	6,212	6,957	7,454	7,802	9,939	14,908	7,454	2236	4472	7454
2-1/2 x 8	3-7/8"	4.440	95,000	253,073	5,747	5,272	6,590	7,381	7,909	8,278	10,545	15,817	7,909	2373	4745	7909
2-3/4 x 8	4-1/4"	5.422	95,000	309,076	7,720	7,083	8,854	9,916	10,624	11,120	14,166	21,249	10,624	3187	6375	10624
3 x 8	4-5/8"	6.503	95,000	370,672	10,101	9,267	11,584	12,974	13,900	14,549	18,534	27,800	13,900	4170	8340	13900
3-1/4 x 8	5"	7.682	95,000	437,862	12,926	11,859	14,823	16,602	17,788	18,618	23,718	35,576	17,788	5336	10673	17788
3-1/2 x 8	5-3/8"	8.959	95,000	510,644	16,234	14,894	18,617	20,851	22,341	23,383	29,788	44,681	22,341	6702	13404	22341
3-3/4 x 8	5-3/4"	10.334	95,000	589,020	20,063	18,407	23,009	25,770	27,610	28,899	36,814	55,221	27,610	8283	16566	27610
4 x 8	6-1/8"	11.807	95,000	672,989	24,452	22,433	28,041	31,406	33,649	35,220	44,866	67,299	33,649	10095	20190	33649
4-1/4 x 8	6-1/2"	13.378	85,000	682,282	26,339	24,164	30,205	33,830	36,246	37,938	48,328	72,492	36,246	10874	21748	36246
4-1/2 x 8	6-7/8"	15.047	85,000	767,421	31,368	28,778	35,973	40,290	43,167	45,182	57,557	86,335	43,167	12950	25900	43167
4-3/4 x 8	7-1/4"	16.815	85,000	857,564	37,000	33,945	42,432	47,523	50,918	53,294	67,890	101,836	50,918	15275	30551	50918
5 x 8	7-5/8"	18.681	85,000	952,711	43,269	39,696	49,620	55,575	59,544	62,323	79,393	119,089	59,544	17863	35727	59544
5-1/4 x 8	8"	20.644	85,000	1,052,863	50,208	46,063	57,578	64,488	69,094	72,319	92,126	138,188	69,094	20728	41456	69094
5-1/2 x 8	8-3/8"	22.706	85,000	1,158,019	57,853	53,076	66,345	74,306	79,614	83,329	106,152	159,228	79,614	23884	47768	79614
5-3/4 x 8	8-3/4"	24.866	85,000	1,268,180	66,236	60,767	75,959	85,074	91,150	95,404	121,534	182,301	91,150	27345	54690	91150
6 x 8	9-1/8"	27.124	85,000	1,383,345	75,392	69,167	86,459	96,834	103,751	108,593	138,334	207,502	103,751	31125	62251	103751

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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HYTORC

TORQUE GUIDE FOR ASTM **A193** GRADE **B16** STUD					REQUIRED TORQUE (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT TENSION BASED ON			70	% YIELD												
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300	First Pass	Second Pass	All Subsequent Passes
													0.15	**30%**	**60%**	**100%**
3/4 x 10	1-1/4"	0.334	105,000	24,570	167	154	192	215	230	241	307	461	230	69	138	230
7/8 x 9	1-7/16"	0.461	105,000	33,920	270	247	309	346	371	388	495	742	371	111	223	371
1x 8	1-5/8"	0.605	105,000	44,500	404	371	464	519	556	582	742	1,112	556	167	334	556
1-1/8 x 8	1-13/16"	0.790	105,000	58,069	593	544	680	762	817	855	1,089	1,633	817	245	490	817
1-1/4 x 8	2"	0.999	105,000	73,441	834	765	956	1,071	1,148	1,201	1,530	2,295	1,148	344	689	1148
1-3/8 x 8	2-3/16"	1.233	105,000	90,616	1,132	1,038	1,298	1,454	1,557	1,630	2,077	3,115	1,557	467	934	1557
1-1/2 x 8	2-3/8"	1.491	105,000	109,595	1,493	1,370	1,712	1,918	2,055	2,151	2,740	4,110	2,055	616	1233	2055
1-5/8 x 8	2-9/16"	1.774	105,000	130,376	1,924	1,766	2,207	2,472	2,648	2,772	3,531	5,297	2,648	794	1589	2648
1-3/4 x 8	2-3/4"	2.081	105,000	152,960	2,431	2,231	2,788	3,123	3,346	3,502	4,461	6,692	3,346	1004	2008	3346
1-7/8 x 8	2-15/16"	2.413	105,000	177,348	3,020	2,771	3,464	3,879	4,157	4,351	5,542	8,313	4,157	1247	2494	4157
2 x 8	3-1/8"	2.769	105,000	203,538	3,698	3,392	4,240	4,749	5,088	5,326	6,785	10,177	5,088	1527	3053	5088
2-1/8 x 8	3-5/16"	3.150	105,000	231,532	4,469	4,100	5,125	5,740	6,150	6,437	8,200	12,300	6,150	1845	3690	6150
2-1/4 x 8	3-1/2"	3.555	105,000	261,329	5,341	4,900	6,125	6,860	7,350	7,693	9,800	14,700	7,350	2205	4410	7350
2-3/8 x 8	3-11/16"	3.985	105,000	292,928	6,319	5,798	7,247	8,117	8,696	9,102	11,595	17,393	8,696	2609	5218	8696
2-1/2 x 8	3-7/8"	4.440	95,000	295,252	6,705	6,151	7,689	8,612	9,227	9,657	12,302	18,453	9,227	2768	5536	9227
2-3/4 x 8	4-1/4"	5.422	95,000	360,589	9,007	8,263	10,329	11,569	12,395	12,974	16,527	24,790	12,395	3719	7437	12395
3 x 8	4-5/8"	6.503	95,000	432,451	11,784	10,811	13,514	15,136	16,217	16,974	21,623	32,434	16,217	4865	9730	16217
3-1/4 x 8	5"	7.682	95,000	510,839	15,080	13,835	17,294	19,369	20,753	21,721	27,670	41,506	20,753	6226	12452	20753
3-1/2 x 8	5-3/8"	8.959	95,000	595,752	18,940	17,376	21,720	24,327	26,064	27,280	34,752	52,128	26,064	7819	15638	26064
3-3/4 x 8	5-3/4"	10.334	95,000	687,190	23,407	21,475	26,843	30,065	32,212	33,715	42,949	64,424	32,212	9664	19327	32212
4 x 8	6-1/8"	11.807	95,000	785,153	28,527	26,172	32,715	36,640	39,258	41,090	52,344	78,515	39,258	11777	23555	39258
4-1/4 x 8	6-1/2"	13.378	85,000	795,996	30,729	28,192	35,239	39,468	42,287	44,261	56,383	84,575	42,287	12686	25372	42287
4-1/2 x 8	6-7/8"	15.047	85,000	895,324	36,596	33,575	41,968	47,005	50,362	52,712	67,149	100,724	50,362	15109	30217	50362
4-3/4 x 8	7-1/4"	16.815	85,000	1,000,491	43,167	39,603	49,503	55,444	59,404	62,176	79,206	118,808	59,404	17821	35642	59404
5 x 8	7-5/8"	18.681	85,000	1,111,496	50,480	46,312	57,890	64,837	69,469	72,710	92,625	138,937	69,469	20841	41681	69469
5-1/4 x 8	8"	20.644	85,000	1,228,340	58,576	53,740	67,175	75,236	80,610	84,372	107,480	161,220	80,610	24183	48366	80610
5-1/2 x 8	8-3/8"	22.706	85,000	1,351,022	67,495	61,922	77,402	86,691	92,883	97,217	123,844	185,766	92,883	27865	55730	92883
5-3/4 x 8	8-3/4"	24.866	85,000	1,479,543	77,275	70,895	88,618	99,253	106,342	111,305	141,790	212,684	106,342	31903	63805	106342
6 x 8	9-1/8"	27.124	85,000	1,613,902	87,958	80,695	100,869	112,973	121,043	126,691	161,390	242,085	121,043	36313	72626	121043

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TORQUE GUIDE FOR ASTM **A193** GRADE **B16** STUD

BOLT TENSION BASED ON 80 % YIELD

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
					LoaDISC TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300	First Pass	Second Pass	All Subsequent Passes
													0.15	**30%**	**60%**	**100%**
3/4 x 10	1-1/4"	0.334	105,000	28,080	191	176	219	246	263	276	351	527	263	79	158	263
7/8 x 9	1-7/16"	0.461	105,000	38,766	308	283	353	396	424	444	565	848	424	127	254	424
1x 8	1-5/8"	0.605	105,000	50,857	462	424	530	593	636	665	848	1,271	636	191	381	636
1-1/8 x 8	1-13/16"	0.790	105,000	66,364	678	622	778	871	933	977	1,244	1,866	933	280	560	933
1-1/4 x 8	2"	0.999	105,000	83,933	953	874	1,093	1,224	1,311	1,373	1,749	2,623	1,311	393	787	1311
1-3/8 x 8	2-3/16"	1.233	105,000	103,562	1,293	1,187	1,483	1,661	1,780	1,863	2,373	3,560	1,780	534	1068	1780
1-1/2 x 8	2-3/8"	1.491	105,000	125,251	1,707	1,566	1,957	2,192	2,348	2,458	3,131	4,697	2,348	705	1409	2348
1-5/8 x 8	2-9/16"	1.774	105,000	149,001	2,199	2,018	2,522	2,825	3,027	3,168	4,035	6,053	3,027	908	1816	3027
1-3/4 x 8	2-3/4"	2.081	105,000	174,812	2,779	2,549	3,187	3,569	3,824	4,002	5,099	7,648	3,824	1147	2294	3824
1-7/8 x 8	2-15/16"	2.413	105,000	202,683	3,452	3,167	3,959	4,434	4,750	4,972	6,334	9,501	4,750	1425	2850	4750
2 x 8	3-1/8"	2.769	105,000	232,615	4,226	3,877	4,846	5,428	5,815	6,087	7,754	11,631	5,815	1745	3489	5815
2-1/8 x 8	3-5/16"	3.150	105,000	264,608	5,107	4,686	5,857	6,560	7,029	7,357	9,372	14,057	7,029	2109	4217	7029
2-1/4 x 8	3-1/2"	3.555	105,000	298,661	6,104	5,600	7,000	7,840	8,400	8,792	11,200	16,800	8,400	2520	5040	8400
2-3/8 x 8	3-11/16"	3.985	105,000	334,775	7,222	6,626	8,282	9,276	9,939	10,402	13,252	19,877	9,939	2982	5963	9939
2-1/2 x 8	3-7/8"	4.440	95,000	337,431	7,662	7,030	8,787	9,842	10,545	11,037	14,060	21,089	10,545	3163	6327	10545
2-3/4 x 8	4-1/4"	5.422	95,000	412,102	10,294	9,444	11,805	13,222	14,166	14,827	18,888	28,332	14,166	4250	8500	14166
3 x 8	4-5/8"	6.503	95,000	494,230	13,468	12,356	15,445	17,298	18,534	19,399	24,711	37,067	18,534	5560	11120	18534
3-1/4 x 8	5"	7.682	95,000	583,816	17,235	15,812	19,765	22,136	23,718	24,824	31,623	47,435	23,718	7115	14231	23718
3-1/2 x 8	5-3/8"	8.959	95,000	680,859	21,646	19,858	24,823	27,802	29,788	31,178	39,717	59,575	29,788	8936	17873	29788
3-3/4 x 8	5-3/4"	10.334	95,000	785,360	26,751	24,542	30,678	34,359	36,814	38,532	49,085	73,627	36,814	11044	22088	36814
4 x 8	6-1/8"	11.807	95,000	897,318	32,603	29,911	37,388	41,875	44,866	46,960	59,821	89,732	44,866	13460	26920	44866
4-1/4 x 8	6-1/2"	13.378	85,000	909,709	35,119	32,219	40,274	45,106	48,328	50,584	64,438	96,657	48,328	14498	28997	48328
4-1/2 x 8	6-7/8"	15.047	85,000	1,023,228	41,824	38,371	47,964	53,719	57,557	60,243	76,742	115,113	57,557	17267	34534	57557
4-3/4 x 8	7-1/4"	16.815	85,000	1,143,418	49,334	45,260	56,575	63,364	67,890	71,059	90,521	135,781	67,890	20367	40734	67890
5 x 8	7-5/8"	18.681	85,000	1,270,282	57,692	52,928	66,160	74,100	79,393	83,098	105,857	158,785	79,393	23818	47636	79393
5-1/4 x 8	8"	20.644	85,000	1,403,817	66,945	61,417	76,771	85,984	92,126	96,425	122,834	184,251	92,126	27638	55275	92126
5-1/2 x 8	8-3/8"	22.706	85,000	1,544,026	77,137	70,768	88,460	99,075	106,152	111,106	141,536	212,304	106,152	31846	63691	106152
5-3/4 x 8	8-3/4"	24.866	85,000	1,690,906	88,315	81,023	101,278	113,432	121,534	127,205	162,045	243,068	121,534	36460	72920	121534
6 x 8	9-1/8"	27.124	85,000	1,844,460	100,523	92,223	115,279	129,112	138,334	144,790	184,446	276,669	138,334	41500	83001	138334

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

REV 7.31.09

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To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
If 'K' factor is not listed, Enter appropriate value under Custom (insert K) , in yellow field only
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HYTORC

TORQUE GUIDE FOR ASTM **A193** GRADE **B16** STUD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT TENSION BASED ON			90	% YIELD												
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	105,000	31,590	215	197	247	276	296	310	395	592	296	89	178	296
7/8 x 9	1-7/16"	0.461	105,000	43,612	347	318	398	445	477	499	636	954	477	143	286	477
1x 8	1-5/8"	0.605	105,000	57,214	520	477	596	667	715	749	954	1,430	715	215	429	715
1-1/8 x 8	1-13/16"	0.790	105,000	74,660	763	700	875	980	1,050	1,099	1,400	2,100	1,050	315	630	1050
1-1/4 x 8	2"	0.999	105,000	94,424	1,072	984	1,229	1,377	1,475	1,544	1,967	2,951	1,475	443	885	1475
1-3/8 x 8	2-3/16"	1.233	105,000	116,507	1,455	1,335	1,669	1,869	2,002	2,096	2,670	4,005	2,002	601	1201	2002
1-1/2 x 8	2-3/8"	1.491	105,000	140,907	1,920	1,761	2,202	2,466	2,642	2,765	3,523	5,284	2,642	793	1585	2642
1-5/8 x 8	2-9/16"	1.774	105,000	167,626	2,474	2,270	2,837	3,178	3,405	3,564	4,540	6,810	3,405	1021	2043	3405
1-3/4 x 8	2-3/4"	2.081	105,000	196,663	3,126	2,868	3,585	4,015	4,302	4,503	5,736	8,604	4,302	1291	2581	4302
1-7/8 x 8	2-15/16"	2.413	105,000	228,019	3,883	3,563	4,453	4,988	5,344	5,594	7,126	10,688	5,344	1603	3207	5344
2 x 8	3-1/8"	2.769	105,000	261,692	4,754	4,362	5,452	6,106	6,542	6,848	8,723	13,085	6,542	1963	3925	6542
2-1/8 x 8	3-5/16"	3.150	105,000	297,684	5,746	5,271	6,589	7,380	7,907	8,276	10,543	15,814	7,907	2372	4744	7907
2-1/4 x 8	3-1/2"	3.555	105,000	335,994	6,867	6,300	7,875	8,820	9,450	9,891	12,600	18,900	9,450	2835	5670	9450
2-3/8 x 8	3-11/16"	3.985	105,000	376,622	8,125	7,454	9,317	10,436	11,181	11,703	14,908	22,362	11,181	3354	6709	11181
2-1/2 x 8	3-7/8"	4.440	95,000	379,610	8,620	7,909	9,886	11,072	11,863	12,416	15,817	23,726	11,863	3559	7118	11863
2-3/4 x 8	4-1/4"	5.422	95,000	463,614	11,581	10,624	13,281	14,874	15,937	16,680	21,249	31,873	15,937	4781	9562	15937
3 x 8	4-5/8"	6.503	95,000	556,009	15,151	13,900	17,375	19,460	20,850	21,823	27,800	41,701	20,850	6255	12510	20850
3-1/4 x 8	5"	7.682	95,000	656,793	19,389	17,788	22,235	24,903	26,682	27,927	35,576	53,364	26,682	8005	16009	26682
3-1/2 x 8	5-3/8"	8.959	95,000	765,966	24,351	22,341	27,926	31,277	33,511	35,075	44,681	67,022	33,511	10053	20107	33511
3-3/4 x 8	5-3/4"	10.334	95,000	883,530	30,095	27,610	34,513	38,654	41,415	43,348	55,221	82,831	41,415	12425	24849	41415
4 x 8	6-1/8"	11.807	95,000	1,009,483	36,678	33,649	42,062	47,109	50,474	52,830	67,299	100,948	50,474	15142	30284	50474
4-1/4 x 8	6-1/2"	13.378	85,000	1,023,423	39,508	36,246	45,308	50,745	54,369	56,907	72,492	108,739	54,369	16311	32622	54369
4-1/2 x 8	6-7/8"	15.047	85,000	1,151,131	47,052	43,167	53,959	60,434	64,751	67,773	86,335	129,502	64,751	19425	38851	64751
4-3/4 x 8	7-1/4"	16.815	85,000	1,286,346	55,500	50,918	63,647	71,285	76,377	79,941	101,836	152,754	76,377	22913	45826	76377
5 x 8	7-5/8"	18.681	85,000	1,429,067	64,903	59,544	74,431	83,362	89,317	93,485	119,089	178,633	89,317	26795	53590	89317
5-1/4 x 8	8"	20.644	85,000	1,579,294	75,313	69,094	86,368	96,732	103,641	108,478	138,188	207,282	103,641	31092	62185	103641
5-1/2 x 8	8-3/8"	22.706	85,000	1,737,029	86,779	79,614	99,517	111,459	119,421	124,994	159,228	238,841	119,421	35826	71652	119421
5-3/4 x 8	8-3/4"	24.866	85,000	1,902,270	99,354	91,150	113,938	127,611	136,726	143,106	182,301	273,451	136,726	41018	82035	136726
6 x 8	9-1/8"	27.124	85,000	2,075,017	113,088	103,751	129,689	145,251	155,626	162,889	207,502	311,253	155,626	46688	93376	155626

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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HYTORC

TORQUE GUIDE FOR ASTM **A193** GRADE **B16** STUD

BOLT TENSION BASED ON 99 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	105,000	34,749	237	217	271	304	326	341	434	652	326	98	195	326
7/8 x 9	1-7/16"	0.461	105,000	47,973	381	350	437	490	525	549	700	1,049	525	157	315	525
1x 8	1-5/8"	0.605	105,000	62,935	572	524	656	734	787	823	1,049	1,573	787	236	472	787
1-1/8 x 8	1-13/16"	0.790	105,000	82,126	839	770	962	1,078	1,155	1,209	1,540	2,310	1,155	346	693	1155
1-1/4 x 8	2"	0.999	105,000	103,867	1,179	1,082	1,352	1,515	1,623	1,699	2,164	3,246	1,623	487	974	1623
1-3/8 x 8	2-3/16"	1.233	105,000	128,157	1,601	1,468	1,836	2,056	2,203	2,305	2,937	4,405	2,203	661	1322	2203
1-1/2 x 8	2-3/8"	1.491	105,000	154,998	2,112	1,937	2,422	2,712	2,906	3,042	3,875	5,812	2,906	872	1744	2906
1-5/8 x 8	2-9/16"	1.774	105,000	184,389	2,722	2,497	3,121	3,496	3,745	3,920	4,994	7,491	3,745	1124	2247	3745
1-3/4 x 8	2-3/4"	2.081	105,000	216,330	3,439	3,155	3,944	4,417	4,732	4,953	6,310	9,464	4,732	1420	2839	4732
1-7/8 x 8	2-15/16"	2.413	105,000	250,821	4,272	3,919	4,899	5,487	5,879	6,153	7,838	11,757	5,879	1764	3527	5879
2 x 8	3-1/8"	2.769	105,000	287,862	5,229	4,798	5,997	6,717	7,197	7,532	9,595	14,393	7,197	2159	4318	7197
2-1/8 x 8	3-5/16"	3.150	105,000	327,452	6,321	5,799	7,248	8,118	8,698	9,104	11,597	17,396	8,698	2609	5219	8698
2-1/4 x 8	3-1/2"	3.555	105,000	369,593	7,554	6,930	8,662	9,702	10,395	10,880	13,860	20,790	10,395	3118	6237	10395
2-3/8 x 8	3-11/16"	3.985	105,000	414,284	8,937	8,199	10,249	11,479	12,299	12,873	16,399	24,598	12,299	3690	7379	12299
2-1/2 x 8	3-7/8"	4.440	95,000	417,570	9,482	8,699	10,874	12,179	13,049	13,658	17,399	26,098	13,049	3915	7829	13049
2-3/4 x 8	4-1/4"	5.422	95,000	509,976	12,739	11,687	14,609	16,362	17,530	18,348	23,374	35,061	17,530	5259	10518	17530
3 x 8	4-5/8"	6.503	95,000	611,609	16,666	15,290	19,113	21,406	22,935	24,006	30,580	45,871	22,935	6881	13761	22935
3-1/4 x 8	5"	7.682	95,000	722,472	21,328	19,567	24,459	27,394	29,350	30,720	39,134	58,701	29,350	8805	17610	29350
3-1/2 x 8	5-3/8"	8.959	95,000	842,563	26,786	24,575	30,718	34,405	36,862	38,582	49,150	73,724	36,862	11059	22117	36862
3-3/4 x 8	5-3/4"	10.334	95,000	971,883	33,105	30,371	37,964	42,520	45,557	47,683	60,743	91,114	45,557	13667	27334	45557
4 x 8	6-1/8"	11.807	95,000	1,110,431	40,346	37,014	46,268	51,820	55,522	58,113	74,029	111,043	55,522	16656	33313	55522
4-1/4 x 8	6-1/2"	13.378	85,000	1,125,765	43,459	39,871	49,839	55,819	59,806	62,597	79,742	119,613	59,806	17942	35884	59806
4-1/2 x 8	6-7/8"	15.047	85,000	1,266,244	51,758	47,484	59,355	66,478	71,226	74,550	94,968	142,452	71,226	21368	42736	71226
4-3/4 x 8	7-1/4"	16.815	85,000	1,414,980	61,050	56,010	70,012	78,413	84,014	87,935	112,019	168,029	84,014	25204	50409	84014
5 x 8	7-5/8"	18.681	85,000	1,571,973	71,394	65,499	81,874	91,698	98,248	102,833	130,998	196,497	98,248	29475	58949	98248
5-1/4 x 8	8"	20.644	85,000	1,737,224	82,844	76,004	95,004	106,405	114,005	119,326	152,007	228,011	114,005	34202	68403	114005
5-1/2 x 8	8-3/8"	22.706	85,000	1,910,732	95,457	87,575	109,469	122,605	131,363	137,493	175,150	262,726	131,363	39409	78818	131363
5-3/4 x 8	8-3/4"	24.866	85,000	2,092,497	109,289	100,265	125,332	140,372	150,398	157,417	200,531	300,796	150,398	45119	90239	150398
6 x 8	9-1/8"	27.124	85,000	2,282,519	124,397	114,126	142,657	159,776	171,189	179,178	228,252	342,378	171,189	51357	102713	171189

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TORQUE GUIDE FOR SAE J429 GR 5 STUD BOLT TENSION BASED ON 40 % YIELD					REQUIRED TORQUE (FtLbs)									THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	92,000	12,302	84	77	96	108	115	121	154	231	115	35	69	115
7/8 x 9	1-7/16"	0.461	92,000	16,983	135	124	155	173	186	194	248	372	186	56	111	186
1x 8	1-5/8"	0.605	92,000	22,280	202	186	232	260	279	291	371	557	279	84	167	279
1-1/8 x 8	1-13/16"	0.790	81,000	25,598	262	240	300	336	360	377	480	720	360	108	216	360
1-1/4 x 8	2"	0.999	81,000	32,374	368	337	422	472	506	529	674	1,012	506	152	304	506
1-3/8 x 8	2-3/16"	1.233	81,000	39,945	499	458	572	641	687	719	915	1,373	687	206	412	687
1-1/2 x 8	2-3/8"	1.491	81,000	48,311	658	604	755	845	906	948	1,208	1,812	906	272	544	906

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TORQUE GUIDE FOR SAE J429 GR 5 STUD

BOLT TENSION BASED ON 50 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	92,000	15,377	105	96	120	135	144	151	192	288	144	43	86	144
7/8 x 9	1-7/16"	0.461	92,000	21,229	169	155	193	217	232	243	310	464	232	70	139	232
1x 8	1-5/8"	0.605	92,000	27,850	253	232	290	325	348	364	464	696	348	104	209	348
1-1/8 x 8	1-13/16"	0.790	81,000	31,997	327	300	375	420	450	471	600	900	450	135	270	450
1-1/4 x 8	2"	0.999	81,000	40,468	459	422	527	590	632	662	843	1,265	632	190	379	632
1-3/8 x 8	2-3/16"	1.233	81,000	49,931	624	572	715	801	858	898	1,144	1,716	858	257	515	858
1-1/2 x 8	2-3/8"	1.491	81,000	60,389	823	755	944	1,057	1,132	1,185	1,510	2,265	1,132	340	679	1132

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TORQUE GUIDE FOR SAE J429 GR 5 STUD

BOLT TENSION BASED ON 60 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	92,000	18,453	126	115	144	161	173	181	231	346	173	52	104	173
7/8 x 9	1-7/16"	0.461	92,000	25,475	202	186	232	260	279	292	372	557	279	84	167	279
1x 8	1-5/8"	0.605	92,000	33,420	304	279	348	390	418	437	557	836	418	125	251	418
1-1/8 x 8	1-13/16"	0.790	81,000	38,397	392	360	450	504	540	565	720	1,080	540	162	324	540
1-1/4 x 8	2"	0.999	81,000	48,561	551	506	632	708	759	794	1,012	1,518	759	228	455	759
1-3/8 x 8	2-3/16"	1.233	81,000	59,918	748	687	858	961	1,030	1,078	1,373	2,060	1,030	309	618	1030
1-1/2 x 8	2-3/8"	1.491	81,000	72,467	987	906	1,132	1,268	1,359	1,422	1,812	2,718	1,359	408	815	1359

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
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Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

REV 7.31.09

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To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
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HYTORC

TORQUE GUIDE FOR SAE J429 GR 5 STUD BOLT TENSION BASED ON 70 % YIELD					REQUIRED TORQUE (FtLbs)									THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	92,000	21,528	147	135	168	188	202	211	269	404	202	61	121	202
7/8 x 9	1-7/16"	0.461	92,000	29,721	236	217	271	303	325	340	433	650	325	98	195	325
1x 8	1-5/8"	0.605	92,000	38,990	354	325	406	455	487	510	650	975	487	146	292	487
1-1/8 x 8	1-13/16"	0.790	81,000	44,796	458	420	525	588	630	659	840	1,260	630	189	378	630
1-1/4 x 8	2"	0.999	81,000	56,655	643	590	738	826	885	927	1,180	1,770	885	266	531	885
1-3/8 x 8	2-3/16"	1.233	81,000	69,904	873	801	1,001	1,121	1,201	1,258	1,602	2,403	1,201	360	721	1201
1-1/2 x 8	2-3/8"	1.491	81,000	84,544	1,152	1,057	1,321	1,480	1,585	1,659	2,114	3,170	1,585	476	951	1585

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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HYTORC

TORQUE GUIDE FOR SAE J429 GR 5 STUD

BOLT TENSION BASED ON 80 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	92,000	24,604	168	154	192	215	231	241	308	461	231	69	138	231
7/8 x 9	1-7/16"	0.461	92,000	33,966	270	248	310	347	372	389	495	743	372	111	223	372
1x 8	1-5/8"	0.605	92,000	44,560	405	371	464	520	557	583	743	1,114	557	167	334	557
1-1/8 x 8	1-13/16"	0.790	81,000	51,195	523	480	600	672	720	754	960	1,440	720	216	432	720
1-1/4 x 8	2"	0.999	81,000	64,748	735	674	843	944	1,012	1,059	1,349	2,023	1,012	304	607	1012
1-3/8 x 8	2-3/16"	1.233	81,000	79,890	998	915	1,144	1,282	1,373	1,437	1,831	2,746	1,373	412	824	1373
1-1/2 x 8	2-3/8"	1.491	81,000	96,622	1,316	1,208	1,510	1,691	1,812	1,896	2,416	3,623	1,812	544	1087	1812

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HYTORC

TORQUE GUIDE FOR SAE J429 GR 5 STUD BOLT TENSION BASED ON 90 % YIELD					REQUIRED TORQUE (FtLbs)									THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	92,000	27,679	189	173	216	242	259	272	346	519	259	78	156	259
7/8 x 9	1-7/16"	0.461	92,000	38,212	304	279	348	390	418	437	557	836	418	125	251	418
1x 8	1-5/8"	0.605	92,000	50,130	455	418	522	585	627	656	836	1,253	627	188	376	627
1-1/8 x 8	1-13/16"	0.790	81,000	57,595	589	540	675	756	810	848	1,080	1,620	810	243	486	810
1-1/4 x 8	2"	0.999	81,000	72,842	827	759	948	1,062	1,138	1,191	1,518	2,276	1,138	341	683	1138
1-3/8 x 8	2-3/16"	1.233	81,000	89,877	1,123	1,030	1,287	1,442	1,545	1,617	2,060	3,090	1,545	463	927	1545
1-1/2 x 8	2-3/8"	1.491	81,000	108,700	1,481	1,359	1,698	1,902	2,038	2,133	2,718	4,076	2,038	611	1223	2038

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HYTORC

TORQUE GUIDE FOR SAE J429 GR 5 STUD BOLT TENSION BASED ON 90 % YIELD					REQUIRED TORQUE (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	92,000	27,679	189	173	216	242	259	272	346	519	259	78	156	259
7/8 x 9	1-7/16"	0.461	92,000	38,212	304	279	348	390	418	437	557	836	418	125	251	418
1x 8	1-5/8"	0.605	92,000	50,130	455	418	522	585	627	656	836	1,253	627	188	376	627
1-1/8 x 8	1-13/16"	0.790	81,000	57,595	589	540	675	756	810	848	1,080	1,620	810	243	486	810
1-1/4 x 8	2"	0.999	81,000	72,842	827	759	948	1,062	1,138	1,191	1,518	2,276	1,138	341	683	1138
1-3/8 x 8	2-3/16"	1.233	81,000	89,877	1,123	1,030	1,287	1,442	1,545	1,617	2,060	3,090	1,545	463	927	1545
1-1/2 x 8	2-3/8"	1.491	81,000	108,700	1,481	1,359	1,698	1,902	2,038	2,133	2,718	4,076	2,038	611	1223	2038

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TORQUE GUIDE FOR SAE **J429** GRADE **8** STUD BOLT TENSION BASED ON 40 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	130,000	17,383	118	109	136	152	163	171	217	326	163	49	98	163
7/8 x 9	1-7/16"	0.461	130,000	23,998	191	175	219	245	262	275	350	525	262	79	157	262
1x 8	1-5/8"	0.605	130,000	31,483	286	262	328	367	394	412	525	787	394	118	236	394
1-1/8 x 8	1-13/16"	0.790	130,000	41,083	420	385	481	539	578	605	770	1,155	578	173	347	578
1-1/4 x 8	2"	0.999	130,000	51,958	590	541	677	758	812	850	1,082	1,624	812	244	487	812
1-3/8 x 8	2-3/16"	1.233	130,000	64,110	801	735	918	1,028	1,102	1,153	1,469	2,204	1,102	331	661	1102
1-1/2 x 8	2-3/8"	1.491	130,000	77,536	1,056	969	1,212	1,357	1,454	1,522	1,938	2,908	1,454	436	872	1454

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HYTORC

TORQUE GUIDE FOR SAE **J429** GRADE **8** STUD

BOLT TENSION BASED ON 50 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	130,000	21,729	148	136	170	190	204	213	272	407	204	61	122	204
7/8 x 9	1-7/16"	0.461	130,000	29,997	238	219	273	306	328	343	437	656	328	98	197	328
1x 8	1-5/8"	0.605	130,000	39,353	357	328	410	459	492	515	656	984	492	148	295	492
1-1/8 x 8	1-13/16"	0.790	130,000	51,353	525	481	602	674	722	756	963	1,444	722	217	433	722
1-1/4 x 8	2"	0.999	130,000	64,948	737	677	846	947	1,015	1,062	1,353	2,030	1,015	304	609	1015
1-3/8 x 8	2-3/16"	1.233	130,000	80,137	1,001	918	1,148	1,286	1,377	1,442	1,836	2,755	1,377	413	826	1377
1-1/2 x 8	2-3/8"	1.491	130,000	96,920	1,321	1,212	1,514	1,696	1,817	1,902	2,423	3,635	1,817	545	1090	1817

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TORQUE GUIDE FOR SAE **J429** GRADE **8** STUD BOLT TENSION BASED ON 60 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	130,000	26,075	178	163	204	228	244	256	326	489	244	73	147	244
7/8 x 9	1-7/16"	0.461	130,000	35,997	286	262	328	367	394	412	525	787	394	118	236	394
1x 8	1-5/8"	0.605	130,000	47,224	429	394	492	551	590	618	787	1,181	590	177	354	590
1-1/8 x 8	1-13/16"	0.790	130,000	61,624	630	578	722	809	867	907	1,155	1,733	867	260	520	867
1-1/4 x 8	2"	0.999	130,000	77,937	885	812	1,015	1,137	1,218	1,275	1,624	2,436	1,218	365	731	1218
1-3/8 x 8	2-3/16"	1.233	130,000	96,164	1,201	1,102	1,377	1,543	1,653	1,730	2,204	3,306	1,653	496	992	1653
1-1/2 x 8	2-3/8"	1.491	130,000	116,305	1,585	1,454	1,817	2,035	2,181	2,282	2,908	4,361	2,181	654	1308	2181

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TORQUE GUIDE FOR SAE **J429** GRADE **8** STUD BOLT TENSION BASED ON 70 % YIELD					REQUIRED TORQUE (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	130,000	30,420	207	190	238	266	285	299	380	570	285	86	171	285
7/8 x 9	1-7/16"	0.461	130,000	41,996	334	306	383	429	459	481	612	919	459	138	276	459
1x 8	1-5/8"	0.605	130,000	55,095	500	459	574	643	689	721	918	1,377	689	207	413	689
1-1/8 x 8	1-13/16"	0.790	130,000	71,895	735	674	843	944	1,011	1,058	1,348	2,022	1,011	303	607	1011
1-1/4 x 8	2"	0.999	130,000	90,927	1,032	947	1,184	1,326	1,421	1,487	1,894	2,841	1,421	426	852	1421
1-3/8 x 8	2-3/16"	1.233	130,000	112,192	1,401	1,286	1,607	1,800	1,928	2,018	2,571	3,857	1,928	578	1157	1928
1-1/2 x 8	2-3/8"	1.491	130,000	135,689	1,849	1,696	2,120	2,375	2,544	2,663	3,392	5,088	2,544	763	1526	2544

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HYTORC

TORQUE GUIDE FOR SAE **J429** GRADE **8** STUD

BOLT TENSION BASED ON 80 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	130,000	34,766	237	217	272	304	326	341	435	652	326	98	196	326
7/8 x 9	1-7/16"	0.461	130,000	47,996	381	350	437	490	525	549	700	1,050	525	157	315	525
1x 8	1-5/8"	0.605	130,000	62,965	572	525	656	735	787	824	1,049	1,574	787	236	472	787
1-1/8 x 8	1-13/16"	0.790	130,000	82,165	840	770	963	1,078	1,155	1,209	1,541	2,311	1,155	347	693	1155
1-1/4 x 8	2"	0.999	130,000	103,917	1,180	1,082	1,353	1,515	1,624	1,699	2,165	3,247	1,624	487	974	1624
1-3/8 x 8	2-3/16"	1.233	130,000	128,219	1,601	1,469	1,836	2,057	2,204	2,307	2,938	4,408	2,204	661	1322	2204
1-1/2 x 8	2-3/8"	1.491	130,000	155,073	2,113	1,938	2,423	2,714	2,908	3,043	3,877	5,815	2,908	872	1745	2908

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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HYTORC

TORQUE GUIDE FOR SAE **J429** GRADE **8** STUD BOLT TENSION BASED ON 90 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	130,000	39,112	266	244	306	342	367	384	489	733	367	110	220	367
7/8 x 9	1-7/16"	0.461	130,000	53,995	429	394	492	551	591	618	787	1,181	591	177	354	591
1x 8	1-5/8"	0.605	130,000	70,836	643	590	738	826	885	927	1,181	1,771	885	266	531	885
1-1/8 x 8	1-13/16"	0.790	130,000	92,436	945	867	1,083	1,213	1,300	1,361	1,733	2,600	1,300	390	780	1300
1-1/4 x 8	2"	0.999	130,000	116,906	1,327	1,218	1,522	1,705	1,827	1,912	2,436	3,653	1,827	548	1096	1827
1-3/8 x 8	2-3/16"	1.233	130,000	144,246	1,802	1,653	2,066	2,314	2,479	2,595	3,306	4,958	2,479	744	1488	2479
1-1/2 x 8	2-3/8"	1.491	130,000	174,457	2,377	2,181	2,726	3,053	3,271	3,424	4,361	6,542	3,271	981	1963	3271

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

REV 7.31.09

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HYTORC

TORQUE GUIDE FOR SAE **J429** GRADE **8** STUD

BOLT TENSION BASED ON 99 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300	First Pass	Second Pass	All Subsequent Passes
													0.15	**30%**	**60%**	**100%**
3/4 x 10	1-1/4"	0.334	130,000	43,023	293	269	336	376	403	422	538	807	403	121	242	403
7/8 x 9	1-7/16"	0.461	130,000	59,395	472	433	541	606	650	680	866	1,299	650	195	390	650
1x 8	1-5/8"	0.605	130,000	77,920	708	649	812	909	974	1,019	1,299	1,948	974	292	584	974
1-1/8 x 8	1-13/16"	0.790	130,000	101,680	1,039	953	1,192	1,335	1,430	1,497	1,906	2,860	1,430	429	858	1430
1-1/4 x 8	2"	0.999	130,000	128,597	1,460	1,340	1,674	1,875	2,009	2,103	2,679	4,019	2,009	603	1206	2009
1-3/8 x 8	2-3/16"	1.233	130,000	158,671	1,982	1,818	2,273	2,545	2,727	2,854	3,636	5,454	2,727	818	1636	2727
1-1/2 x 8	2-3/8"	1.491	130,000	191,902	2,615	2,399	2,998	3,358	3,598	3,766	4,798	7,196	3,598	1079	2159	3598

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TORQUE GUIDE FOR ISO **R898** GRADE **8.8** STUD BOLT TENSION BASED ON **40** % YIELD					REQUIRED TORQUE (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	96,000	12,837	87	80	100	112	120	126	160	241	120	36	72	120
7/8 x 9	1-7/16"	0.461	96,000	17,722	141	129	162	181	194	203	258	388	194	58	116	194
1x 8	1-5/8"	0.605	96,000	23,249	211	194	242	271	291	304	387	581	291	87	174	291
1-1/8 x 8	1-13/16"	0.790	96,000	30,338	310	284	356	398	427	447	569	853	427	128	256	427
1-1/4 x 8	2"	0.999	96,000	38,369	436	400	500	560	600	627	799	1,199	600	180	360	600
1-3/8 x 8	2-3/16"	1.233	96,000	47,342	591	542	678	759	814	852	1,085	1,627	814	244	488	814
1-1/2 x 8	2-3/8"	1.491	96,000	57,258	780	716	895	1,002	1,074	1,124	1,431	2,147	1,074	322	644	1074
1-5/8 x 8	2-9/16"	1.774	96,000	68,115	1,005	922	1,153	1,291	1,384	1,448	1,845	2,767	1,384	415	830	1384
1-3/4 x 8	2-3/4"	2.081	96,000	79,914	1,270	1,165	1,457	1,632	1,748	1,830	2,331	3,496	1,748	524	1049	1748
1-7/8 x 8	2-15/16"	2.413	96,000	92,655	1,578	1,448	1,810	2,027	2,172	2,273	2,895	4,343	2,172	651	1303	2172
2 x 8	3-1/8"	2.769	96,000	106,338	1,932	1,772	2,215	2,481	2,658	2,783	3,545	5,317	2,658	798	1595	2658
2-1/8 x 8	3-5/16"	3.150	96,000	120,964	2,335	2,142	2,678	2,999	3,213	3,363	4,284	6,426	3,213	964	1928	3213
2-1/4 x 8	3-1/2"	3.555	96,000	136,531	2,790	2,560	3,200	3,584	3,840	4,019	5,120	7,680	3,840	1152	2304	3840
2-3/8 x 8	3-11/16"	3.985	96,000	153,040	3,302	3,029	3,786	4,240	4,543	4,755	6,058	9,087	4,543	1363	2726	4543
2-1/2 x 8	3-7/8"	4.440	96,000	170,491	3,872	3,552	4,440	4,973	5,328	5,576	7,104	10,656	5,328	1598	3197	5328
2-3/4 x 8	4-1/4"	5.422	96,000	208,220	5,201	4,772	5,965	6,680	7,158	7,492	9,543	14,315	7,158	2147	4295	7158
3 x 8	4-5/8"	6.503	96,000	249,716	6,805	6,243	7,804	8,740	9,364	9,801	12,486	18,729	9,364	2809	5619	9364
3-1/4 x 8	5"	7.682	96,000	294,981	8,708	7,989	9,986	11,185	11,984	12,543	15,978	23,967	11,984	3595	7190	11984
3-1/2 x 8	5-3/8"	8.959	96,000	344,013	10,937	10,034	12,542	14,047	15,051	15,753	20,067	30,101	15,051	4515	9030	15051
3-3/4 x 8	5-3/4"	10.334	96,000	396,813	13,516	12,400	15,501	17,361	18,601	19,469	24,801	37,201	18,601	5580	11160	18601
4 x 8	6-1/8"	11.807	96,000	453,382	16,473	15,113	18,891	21,158	22,669	23,727	30,225	45,338	22,669	6801	13601	22669
4-1/4 x 8	6-1/2"	13.378	96,000	513,718	19,832	18,194	22,743	25,472	27,291	28,565	36,388	54,583	27,291	8187	16375	27291
4-1/2 x 8	6-7/8"	15.047	96,000	577,823	23,619	21,668	27,085	30,336	32,503	34,019	43,337	65,005	32,503	9751	19502	32503
4-3/4 x 8	7-1/4"	16.815	96,000	645,695	27,859	25,559	31,948	35,782	38,338	40,127	51,118	76,676	38,338	11501	23003	38338
5 x 8	7-5/8"	18.681	96,000	717,335	32,579	29,889	37,361	41,845	44,833	46,926	59,778	89,667	44,833	13450	26900	44833
5-1/4 x 8	8"	20.644	96,000	792,744	37,804	34,683	43,353	48,556	52,024	54,452	69,365	104,048	52,024	15607	31214	52024
5-1/2 x 8	8-3/8"	22.706	96,000	871,920	43,560	39,963	49,954	55,948	59,945	62,742	79,926	119,889	59,945	17983	35967	59945
5-3/4 x 8	8-3/4"	24.866	96,000	954,865	49,872	45,754	57,192	64,056	68,631	71,834	91,508	137,262	68,631	20589	41179	68631
6 x 8	9-1/8"	27.124	96,000	1,041,577	56,766	52,079	65,099	72,910	78,118	81,764	104,158	156,237	78,118	23435	46871	78118

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TORQUE GUIDE FOR ISO **R898** GRADE **8.8** STUD

BOLT TENSION BASED ON 50 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	96,000	16,046	109	100	125	140	150	157	201	301	150	45	90	150
7/8 x 9	1-7/16"	0.461	96,000	22,152	176	162	202	226	242	254	323	485	242	73	145	242
1x 8	1-5/8"	0.605	96,000	29,061	264	242	303	339	363	380	484	727	363	109	218	363
1-1/8 x 8	1-13/16"	0.790	96,000	37,922	388	356	444	498	533	558	711	1,067	533	160	320	533
1-1/4 x 8	2"	0.999	96,000	47,961	545	500	624	699	749	784	999	1,499	749	225	450	749
1-3/8 x 8	2-3/16"	1.233	96,000	59,178	739	678	848	949	1,017	1,065	1,356	2,034	1,017	305	610	1017
1-1/2 x 8	2-3/8"	1.491	96,000	71,572	975	895	1,118	1,253	1,342	1,405	1,789	2,684	1,342	403	805	1342
1-5/8 x 8	2-9/16"	1.774	96,000	85,144	1,257	1,153	1,441	1,614	1,729	1,810	2,306	3,459	1,729	519	1038	1729
1-3/4 x 8	2-3/4"	2.081	96,000	99,893	1,588	1,457	1,821	2,039	2,185	2,287	2,914	4,370	2,185	656	1311	2185
1-7/8 x 8	2-15/16"	2.413	96,000	115,819	1,973	1,810	2,262	2,534	2,715	2,841	3,619	5,429	2,715	814	1629	2715
2 x 8	3-1/8"	2.769	96,000	132,923	2,415	2,215	2,769	3,102	3,323	3,478	4,431	6,646	3,323	997	1994	3323
2-1/8 x 8	3-5/16"	3.150	96,000	151,205	2,919	2,678	3,347	3,749	4,016	4,204	5,355	8,033	4,016	1205	2410	4016
2-1/4 x 8	3-1/2"	3.555	96,000	170,664	3,488	3,200	4,000	4,480	4,800	5,024	6,400	9,600	4,800	1440	2880	4800
2-3/8 x 8	3-11/16"	3.985	96,000	191,300	4,127	3,786	4,733	5,301	5,679	5,944	7,572	11,358	5,679	1704	3408	5679
2-1/2 x 8	3-7/8"	4.440	96,000	213,114	4,839	4,440	5,550	6,216	6,660	6,971	8,880	13,320	6,660	1998	3996	6660
2-3/4 x 8	4-1/4"	5.422	96,000	260,275	6,501	5,965	7,456	8,350	8,947	9,364	11,929	17,894	8,947	2684	5368	8947
3 x 8	4-5/8"	6.503	96,000	312,145	8,506	7,804	9,755	10,925	11,705	12,252	15,607	23,411	11,705	3512	7023	11705
3-1/4 x 8	5"	7.682	96,000	368,726	10,885	9,986	12,483	13,981	14,979	15,679	19,973	29,959	14,979	4494	8988	14979
3-1/2 x 8	5-3/8"	8.959	96,000	430,016	13,671	12,542	15,678	17,559	18,813	19,691	25,084	37,626	18,813	5644	11288	18813
3-3/4 x 8	5-3/4"	10.334	96,000	496,017	16,896	15,501	19,376	21,701	23,251	24,336	31,001	46,502	23,251	6975	13950	23251
4 x 8	6-1/8"	11.807	96,000	566,727	20,591	18,891	23,614	26,447	28,336	29,659	37,782	56,673	28,336	8501	17002	28336
4-1/4 x 8	6-1/2"	13.378	96,000	642,148	24,790	22,743	28,428	31,840	34,114	35,706	45,485	68,228	34,114	10234	20468	34114
4-1/2 x 8	6-7/8"	15.047	96,000	722,278	29,523	27,085	33,857	37,920	40,628	42,524	54,171	81,256	40,628	12188	24377	40628
4-3/4 x 8	7-1/4"	16.815	96,000	807,119	34,824	31,948	39,936	44,728	47,923	50,159	63,897	95,845	47,923	14377	28754	47923
5 x 8	7-5/8"	18.681	96,000	896,669	40,724	37,361	46,702	52,306	56,042	58,657	74,722	112,084	56,042	16813	33625	56042
5-1/4 x 8	8"	20.644	96,000	990,930	47,255	43,353	54,191	60,694	65,030	68,064	86,706	130,060	65,030	19509	39018	65030
5-1/2 x 8	8-3/8"	22.706	96,000	1,089,900	54,450	49,954	62,442	69,935	74,931	78,427	99,908	149,861	74,931	22479	44958	74931
5-3/4 x 8	8-3/4"	24.866	96,000	1,193,581	62,340	57,192	71,491	80,069	85,789	89,792	114,385	171,577	85,789	25737	51473	85789
6 x 8	9-1/8"	27.124	96,000	1,301,971	70,957	65,099	81,373	91,138	97,648	102,205	130,197	195,296	97,648	29294	58589	97648

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HYTORC

TORQUE GUIDE FOR ISO **R898** GRADE **8.8** STUD BOLT TENSION BASED ON 60 % YIELD					**REQUIRED TORQUE** (FtLbs)									THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	96,000	19,255	131	120	150	168	181	189	241	361	181	54	108	181
7/8 x 9	1-7/16"	0.461	96,000	26,582	211	194	242	271	291	304	388	581	291	87	174	291
1x 8	1-5/8"	0.605	96,000	34,873	317	291	363	407	436	456	581	872	436	131	262	436
1-1/8 x 8	1-13/16"	0.790	96,000	45,507	465	427	533	597	640	670	853	1,280	640	192	384	640
1-1/4 x 8	2"	0.999	96,000	57,554	653	600	749	839	899	941	1,199	1,799	899	270	540	899
1-3/8 x 8	2-3/16"	1.233	96,000	71,014	887	814	1,017	1,139	1,221	1,278	1,627	2,441	1,221	366	732	1221
1-1/2 x 8	2-3/8"	1.491	96,000	85,886	1,170	1,074	1,342	1,503	1,610	1,686	2,147	3,221	1,610	483	966	1610
1-5/8 x 8	2-9/16"	1.774	96,000	102,172	1,508	1,384	1,729	1,937	2,075	2,172	2,767	4,151	2,075	623	1245	2075
1-3/4 x 8	2-3/4"	2.081	96,000	119,871	1,905	1,748	2,185	2,447	2,622	2,745	3,496	5,244	2,622	787	1573	2622
1-7/8 x 8	2-15/16"	2.413	96,000	138,983	2,367	2,172	2,715	3,040	3,257	3,409	4,343	6,515	3,257	977	1954	3257
2 x 8	3-1/8"	2.769	96,000	159,508	2,898	2,658	3,323	3,722	3,988	4,174	5,317	7,975	3,988	1196	2393	3988
2-1/8 x 8	3-5/16"	3.150	96,000	181,445	3,502	3,213	4,016	4,498	4,820	5,045	6,426	9,639	4,820	1446	2892	4820
2-1/4 x 8	3-1/2"	3.555	96,000	204,796	4,186	3,840	4,800	5,376	5,760	6,029	7,680	11,520	5,760	1728	3456	5760
2-3/8 x 8	3-11/16"	3.985	96,000	229,560	4,952	4,543	5,679	6,361	6,815	7,133	9,087	13,630	6,815	2045	4089	6815
2-1/2 x 8	3-7/8"	4.440	96,000	255,737	5,807	5,328	6,660	7,459	7,992	8,365	10,656	15,984	7,992	2398	4795	7992
2-3/4 x 8	4-1/4"	5.422	96,000	312,330	7,802	7,158	8,947	10,021	10,736	11,237	14,315	21,473	10,736	3221	6442	10736
3 x 8	4-5/8"	6.503	96,000	374,574	10,207	9,364	11,705	13,110	14,047	14,702	18,729	28,093	14,047	4214	8428	14047
3-1/4 x 8	5"	7.682	96,000	442,471	13,062	11,984	14,979	16,777	17,975	18,814	23,967	35,951	17,975	5393	10785	17975
3-1/2 x 8	5-3/8"	8.959	96,000	516,019	16,405	15,051	18,813	21,071	22,576	23,629	30,101	45,152	22,576	6773	13546	22576
3-3/4 x 8	5-3/4"	10.334	96,000	595,220	20,275	18,601	23,251	26,041	27,901	29,203	37,201	55,802	27,901	8370	16741	27901
4 x 8	6-1/8"	11.807	96,000	680,073	24,709	22,669	28,336	31,737	34,004	35,590	45,338	68,007	34,004	10201	20402	34004
4-1/4 x 8	6-1/2"	13.378	96,000	770,577	29,747	27,291	34,114	38,208	40,937	42,847	54,583	81,874	40,937	12281	24562	40937
4-1/2 x 8	6-7/8"	15.047	96,000	866,734	35,428	32,503	40,628	45,504	48,754	51,029	65,005	97,508	48,754	14626	29252	48754
4-3/4 x 8	7-1/4"	16.815	96,000	968,543	41,789	38,338	47,923	53,673	57,507	60,191	76,676	115,014	57,507	17252	34504	57507
5 x 8	7-5/8"	18.681	96,000	1,076,003	48,868	44,833	56,042	62,767	67,250	70,389	89,667	134,500	67,250	20175	40350	67250
5-1/4 x 8	8"	20.644	96,000	1,189,116	56,706	52,024	65,030	72,833	78,036	81,677	104,048	156,071	78,036	23411	46821	78036
5-1/2 x 8	8-3/8"	22.706	96,000	1,307,880	65,340	59,945	74,931	83,922	89,917	94,113	119,889	179,834	89,917	26975	53950	89917
5-3/4 x 8	8-3/4"	24.866	96,000	1,432,297	74,808	68,631	85,789	96,083	102,946	107,751	137,262	205,893	102,946	30884	61768	102946
6 x 8	9-1/8"	27.124	96,000	1,562,366	85,149	78,118	97,648	109,366	117,177	122,646	156,237	234,355	117,177	35153	70306	117177

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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This spread sheet is to be used as a guide. all results should be analyzed against actual field results to establish their validity.
To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
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TORQUE GUIDE FOR ISO **R898** GRADE **8.8** STUD

BOLT TENSION BASED ON 70 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN²)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	96,000	22,464	153	140	176	197	211	220	281	421	211	63	126	211
7/8 x 9	1-7/16"	0.461	96,000	31,013	246	226	283	317	339	355	452	678	339	102	204	339
1x 8	1-5/8"	0.605	96,000	40,685	370	339	424	475	509	532	678	1,017	509	153	305	509
1-1/8 x 8	1-13/16"	0.790	96,000	53,091	543	498	622	697	747	781	995	1,493	747	224	448	747
1-1/4 x 8	2"	0.999	96,000	67,146	762	699	874	979	1,049	1,098	1,399	2,098	1,049	315	629	1049
1-3/8 x 8	2-3/16"	1.233	96,000	82,849	1,035	949	1,187	1,329	1,424	1,490	1,899	2,848	1,424	427	854	1424
1-1/2 x 8	2-3/8"	1.491	96,000	100,201	1,365	1,253	1,566	1,754	1,879	1,966	2,505	3,758	1,879	564	1127	1879
1-5/8 x 8	2-9/16"	1.774	96,000	119,201	1,759	1,614	2,018	2,260	2,421	2,534	3,228	4,843	2,421	726	1453	2421
1-3/4 x 8	2-3/4"	2.081	96,000	139,850	2,223	2,039	2,549	2,855	3,059	3,202	4,079	6,118	3,059	918	1836	3059
1-7/8 x 8	2-15/16"	2.413	96,000	162,147	2,762	2,534	3,167	3,547	3,800	3,978	5,067	7,601	3,800	1140	2280	3800
2 x 8	3-1/8"	2.769	96,000	186,092	3,381	3,102	3,877	4,342	4,652	4,869	6,203	9,305	4,652	1396	2791	4652
2-1/8 x 8	3-5/16"	3.150	96,000	211,686	4,086	3,749	4,686	5,248	5,623	5,885	7,497	11,246	5,623	1687	3374	5623
2-1/4 x 8	3-1/2"	3.555	96,000	238,929	4,883	4,480	5,600	6,272	6,720	7,033	8,960	13,440	6,720	2016	4032	6720
2-3/8 x 8	3-11/16"	3.985	96,000	267,820	5,778	5,301	6,626	7,421	7,951	8,322	10,601	15,902	7,951	2385	4771	7951
2-1/2 x 8	3-7/8"	4.440	96,000	298,360	6,775	6,216	7,770	8,702	9,324	9,759	12,432	18,647	9,324	2797	5594	9324
2-3/4 x 8	4-1/4"	5.422	96,000	364,384	9,102	8,350	10,438	11,691	12,526	13,110	16,701	25,051	12,526	3758	7515	12526
3 x 8	4-5/8"	6.503	96,000	437,003	11,908	10,925	13,656	15,295	16,388	17,152	21,850	32,775	16,388	4916	9833	16388
3-1/4 x 8	5"	7.682	96,000	516,216	15,239	13,981	17,476	19,573	20,971	21,950	27,962	41,943	20,971	6291	12583	20971
3-1/2 x 8	5-3/8"	8.959	96,000	602,023	19,139	17,559	21,949	24,583	26,338	27,568	35,118	52,677	26,338	7902	15803	26338
3-3/4 x 8	5-3/4"	10.334	96,000	694,423	23,654	21,701	27,126	30,381	32,551	34,070	43,401	65,102	32,551	9765	19531	32551
4 x 8	6-1/8"	11.807	96,000	793,418	28,828	26,447	33,059	37,026	39,671	41,522	52,895	79,342	39,671	11901	23803	39671
4-1/4 x 8	6-1/2"	13.378	96,000	899,007	34,705	31,840	39,800	44,576	47,760	49,989	63,680	95,519	47,760	14328	28656	47760
4-1/2 x 8	6-7/8"	15.047	96,000	1,011,190	41,332	37,920	47,400	53,087	56,879	59,534	75,839	113,759	56,879	17064	34128	56879
4-3/4 x 8	7-1/4"	16.815	96,000	1,129,966	48,753	44,728	55,910	62,619	67,092	70,223	89,456	134,184	67,092	20128	40255	67092
5 x 8	7-5/8"	18.681	96,000	1,255,337	57,013	52,306	65,382	73,228	78,459	82,120	104,611	156,917	78,459	23538	47075	78459
5-1/4 x 8	8"	20.644	96,000	1,387,302	66,157	60,694	75,868	84,972	91,042	95,290	121,389	182,083	91,042	27313	54625	91042
5-1/2 x 8	8-3/8"	22.706	96,000	1,525,861	76,229	69,935	87,419	97,909	104,903	109,798	139,871	209,806	104,903	31471	62942	104903
5-3/4 x 8	8-3/4"	24.866	96,000	1,671,013	87,276	80,069	100,087	112,097	120,104	125,709	160,139	240,208	120,104	36031	72062	120104
6 x 8	9-1/8"	27.124	96,000	1,822,760	99,340	91,138	113,923	127,593	136,707	143,087	182,276	273,414	136,707	41012	82024	136707

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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TORQUE GUIDE FOR ISO **R898** GRADE **8.8** STUD BOLT TENSION BASED ON 80 % YIELD					REQUIRED TORQUE (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	96,000	25,674	175	160	201	225	241	252	321	481	241	72	144	241
7/8 x 9	1-7/16"	0.461	96,000	35,443	282	258	323	362	388	406	517	775	388	116	233	388
1x 8	1-5/8"	0.605	96,000	46,498	422	387	484	542	581	608	775	1,162	581	174	349	581
1-1/8 x 8	1-13/16"	0.790	96,000	60,676	620	569	711	796	853	893	1,138	1,707	853	256	512	853
1-1/4 x 8	2"	0.999	96,000	76,738	871	799	999	1,119	1,199	1,255	1,599	2,398	1,199	360	719	1199
1-3/8 x 8	2-3/16"	1.233	96,000	94,685	1,183	1,085	1,356	1,519	1,627	1,703	2,170	3,255	1,627	488	976	1627
1-1/2 x 8	2-3/8"	1.491	96,000	114,515	1,560	1,431	1,789	2,004	2,147	2,247	2,863	4,294	2,147	644	1288	2147
1-5/8 x 8	2-9/16"	1.774	96,000	136,230	2,011	1,845	2,306	2,583	2,767	2,896	3,690	5,534	2,767	830	1660	2767
1-3/4 x 8	2-3/4"	2.081	96,000	159,828	2,541	2,331	2,914	3,263	3,496	3,659	4,662	6,992	3,496	1049	2098	3496
1-7/8 x 8	2-15/16"	2.413	96,000	185,310	3,156	2,895	3,619	4,054	4,343	4,546	5,791	8,686	4,343	1303	2606	4343
2 x 8	3-1/8"	2.769	96,000	212,677	3,864	3,545	4,431	4,962	5,317	5,565	7,089	10,634	5,317	1595	3190	5317
2-1/8 x 8	3-5/16"	3.150	96,000	241,927	4,670	4,284	5,355	5,998	6,426	6,726	8,568	12,852	6,426	1928	3856	6426
2-1/4 x 8	3-1/2"	3.555	96,000	273,062	5,581	5,120	6,400	7,168	7,680	8,038	10,240	15,360	7,680	2304	4608	7680
2-3/8 x 8	3-11/16"	3.985	96,000	306,080	6,603	6,058	7,572	8,481	9,087	9,511	12,116	18,174	9,087	2726	5452	9087
2-1/2 x 8	3-7/8"	4.440	96,000	340,983	7,743	7,104	8,880	9,945	10,656	11,153	14,208	21,311	10,656	3197	6393	10656
2-3/4 x 8	4-1/4"	5.422	96,000	416,439	10,402	9,543	11,929	13,361	14,315	14,983	19,087	28,630	14,315	4295	8589	14315
3 x 8	4-5/8"	6.503	96,000	499,432	13,610	12,486	15,607	17,480	18,729	19,603	24,972	37,457	18,729	5619	11237	18729
3-1/4 x 8	5"	7.682	96,000	589,961	17,416	15,978	19,973	22,369	23,967	25,086	31,956	47,934	23,967	7190	14380	23967
3-1/2 x 8	5-3/8"	8.959	96,000	688,026	21,873	20,067	25,084	28,094	30,101	31,506	40,135	60,202	30,101	9030	18061	30101
3-3/4 x 8	5-3/4"	10.334	96,000	793,627	27,033	24,801	31,001	34,721	37,201	38,937	49,602	74,403	37,201	11160	22321	37201
4 x 8	6-1/8"	11.807	96,000	906,764	32,946	30,225	37,782	42,316	45,338	47,454	60,451	90,676	45,338	13601	27203	45338
4-1/4 x 8	6-1/2"	13.378	96,000	1,027,436	39,663	36,388	45,485	50,944	54,583	57,130	72,777	109,165	54,583	16375	32750	54583
4-1/2 x 8	6-7/8"	15.047	96,000	1,155,645	47,237	43,337	54,171	60,671	65,005	68,039	86,673	130,010	65,005	19502	39003	65005
4-3/4 x 8	7-1/4"	16.815	96,000	1,291,390	55,718	51,118	63,897	71,565	76,676	80,255	102,235	153,353	76,676	23003	46006	76676
5 x 8	7-5/8"	18.681	96,000	1,434,671	65,158	59,778	74,722	83,689	89,667	93,851	119,556	179,334	89,667	26900	53800	89667
5-1/4 x 8	8"	20.644	96,000	1,585,488	75,608	69,365	86,706	97,111	104,048	108,903	138,730	208,095	104,048	31214	62429	104048
5-1/2 x 8	8-3/8"	22.706	96,000	1,743,841	87,119	79,926	99,908	111,896	119,889	125,484	159,852	239,778	119,889	35967	71933	119889
5-3/4 x 8	8-3/4"	24.866	96,000	1,909,729	99,744	91,508	114,385	128,111	137,262	143,667	183,016	274,524	137,262	41179	82357	137262
6 x 8	9-1/8"	27.124	96,000	2,083,154	113,532	104,158	130,197	145,821	156,237	163,528	208,315	312,473	156,237	46871	93742	156237

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HYTORC

TORQUE GUIDE FOR ISO **R898** GRADE **8.8** STUD

BOLT TENSION BASED ON 90 % YIELD

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN²)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
					REQUIRED TORQUE (FtLbs)									THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN		
3/4 x 10	1-1/4"	0.334	96,000	28,883	197	181	226	253	271	283	361	542	271	81	162	271
7/8 x 9	1-7/16"	0.461	96,000	39,874	317	291	363	407	436	456	581	872	436	131	262	436
1x 8	1-5/8"	0.605	96,000	52,310	475	436	545	610	654	684	872	1,308	654	196	392	654
1-1/8 x 8	1-13/16"	0.790	96,000	68,260	698	640	800	896	960	1,005	1,280	1,920	960	288	576	960
1-1/4 x 8	2"	0.999	96,000	86,331	980	899	1,124	1,259	1,349	1,412	1,799	2,698	1,349	405	809	1349
1-3/8 x 8	2-3/16"	1.233	96,000	106,520	1,330	1,221	1,526	1,709	1,831	1,916	2,441	3,662	1,831	549	1098	1831
1-1/2 x 8	2-3/8"	1.491	96,000	128,830	1,755	1,610	2,013	2,255	2,416	2,528	3,221	4,831	2,416	725	1449	2416
1-5/8 x 8	2-9/16"	1.774	96,000	153,258	2,262	2,075	2,594	2,906	3,113	3,258	4,151	6,226	3,113	934	1868	3113
1-3/4 x 8	2-3/4"	2.081	96,000	179,807	2,858	2,622	3,278	3,671	3,933	4,117	5,244	7,867	3,933	1180	2360	3933
1-7/8 x 8	2-15/16"	2.413	96,000	208,474	3,551	3,257	4,072	4,560	4,886	5,114	6,515	9,772	4,886	1466	2932	4886
2 x 8	3-1/8"	2.769	96,000	239,262	4,347	3,988	4,985	5,583	5,982	6,261	7,975	11,963	5,982	1794	3589	5982
2-1/8 x 8	3-5/16"	3.150	96,000	272,168	5,253	4,820	6,025	6,748	7,229	7,567	9,639	14,459	7,229	2169	4338	7229
2-1/4 x 8	3-1/2"	3.555	96,000	307,194	6,278	5,760	7,200	8,064	8,640	9,043	11,520	17,280	8,640	2592	5184	8640
2-3/8 x 8	3-11/16"	3.985	96,000	344,340	7,428	6,815	8,519	9,541	10,223	10,700	13,630	20,445	10,223	3067	6134	10223
2-1/2 x 8	3-7/8"	4.440	96,000	383,605	8,711	7,992	9,990	11,188	11,988	12,547	15,984	23,975	11,988	3596	7193	11988
2-3/4 x 8	4-1/4"	5.422	96,000	468,494	11,703	10,736	13,420	15,031	16,104	16,856	21,473	32,209	16,104	4831	9663	16104
3 x 8	4-5/8"	6.503	96,000	561,861	15,311	14,047	17,558	19,665	21,070	22,053	28,093	42,140	21,070	6321	12642	21070
3-1/4 x 8	5"	7.682	96,000	663,706	19,593	17,975	22,469	25,166	26,963	28,221	35,951	53,926	26,963	8089	16178	26963
3-1/2 x 8	5-3/8"	8.959	96,000	774,029	24,608	22,576	28,220	31,606	33,864	35,444	45,152	67,728	33,864	10159	20318	33864
3-3/4 x 8	5-3/4"	10.334	96,000	892,830	30,412	27,901	34,876	39,061	41,851	43,804	55,802	83,703	41,851	12555	25111	41851
4 x 8	6-1/8"	11.807	96,000	1,020,109	37,064	34,004	42,505	47,605	51,005	53,386	68,007	102,011	51,005	15302	30603	51005
4-1/4 x 8	6-1/2"	13.378	96,000	1,155,866	44,621	40,937	51,171	57,312	61,405	64,271	81,874	122,811	61,405	18422	36843	61405
4-1/2 x 8	6-7/8"	15.047	96,000	1,300,101	53,142	48,754	60,942	68,255	73,131	76,543	97,508	146,261	73,131	21939	43878	73131
4-3/4 x 8	7-1/4"	16.815	96,000	1,452,814	62,683	57,507	71,884	80,510	86,261	90,286	115,014	172,522	86,261	25878	51756	86261
5 x 8	7-5/8"	18.681	96,000	1,614,005	73,303	67,250	84,063	94,150	100,875	105,583	134,500	201,751	100,875	30263	60525	100875
5-1/4 x 8	8"	20.644	96,000	1,783,674	85,059	78,036	97,545	109,250	117,054	122,516	156,071	234,107	117,054	35116	70232	117054
5-1/2 x 8	8-3/8"	22.706	96,000	1,961,821	98,009	89,917	112,396	125,883	134,875	141,169	179,834	269,750	134,875	40463	80925	134875
5-3/4 x 8	8-3/4"	24.866	96,000	2,148,446	112,212	102,946	128,683	144,125	154,420	161,626	205,893	308,839	154,420	46326	92652	154420
6 x 8	9-1/8"	27.124	96,000	2,343,549	127,723	117,177	146,472	164,048	175,766	183,969	234,355	351,532	175,766	52730	105460	175766

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
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TORQUE GUIDE FOR ISO **R898** GRADE **8.8** STUD

BOLT TENSION BASED ON 99 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	96,000	31,771	216	199	248	278	298	312	397	596	298	89	179	298
7/8 x 9	1-7/16"	0.461	96,000	43,861	349	320	400	448	480	502	640	959	480	144	288	480
1x 8	1-5/8"	0.605	96,000	57,541	523	480	599	671	719	753	959	1,439	719	216	432	719
1-1/8 x 8	1-13/16"	0.790	96,000	75,087	767	704	880	986	1,056	1,105	1,408	2,112	1,056	317	634	1056
1-1/4 x 8	2"	0.999	96,000	94,964	1,078	989	1,237	1,385	1,484	1,553	1,978	2,968	1,484	445	890	1484
1-3/8 x 8	2-3/16"	1.233	96,000	117,172	1,463	1,343	1,678	1,880	2,014	2,108	2,685	4,028	2,014	604	1208	2014
1-1/2 x 8	2-3/8"	1.491	96,000	141,713	1,931	1,771	2,214	2,480	2,657	2,781	3,543	5,314	2,657	797	1594	2657
1-5/8 x 8	2-9/16"	1.774	96,000	168,584	2,488	2,283	2,854	3,196	3,424	3,584	4,566	6,849	3,424	1027	2055	3424
1-3/4 x 8	2-3/4"	2.081	96,000	197,787	3,144	2,884	3,605	4,038	4,327	4,529	5,769	8,653	4,327	1298	2596	4327
1-7/8 x 8	2-15/16"	2.413	96,000	229,322	3,906	3,583	4,479	5,016	5,375	5,626	7,166	10,749	5,375	1612	3225	5375
2 x 8	3-1/8"	2.769	96,000	263,188	4,781	4,386	5,483	6,141	6,580	6,887	8,773	13,159	6,580	1974	3948	6580
2-1/8 x 8	3-5/16"	3.150	96,000	299,385	5,779	5,302	6,627	7,422	7,952	8,324	10,603	15,905	7,952	2386	4771	7952
2-1/4 x 8	3-1/2"	3.555	96,000	337,914	6,906	6,336	7,920	8,870	9,504	9,947	12,672	19,008	9,504	2851	5702	9504
2-3/8 x 8	3-11/16"	3.985	96,000	378,774	8,171	7,497	9,371	10,495	11,245	11,770	14,993	22,490	11,245	3373	6747	11245
2-1/2 x 8	3-7/8"	4.440	96,000	421,966	9,582	8,791	10,989	12,307	13,186	13,802	17,582	26,373	13,186	3956	7912	13186
2-3/4 x 8	4-1/4"	5.422	96,000	515,344	12,873	11,810	14,762	16,534	17,715	18,542	23,620	35,430	17,715	5314	10629	17715
3 x 8	4-5/8"	6.503	96,000	618,047	16,842	15,451	19,314	21,632	23,177	24,258	30,902	46,354	23,177	6953	13906	23177
3-1/4 x 8	5"	7.682	96,000	730,077	21,552	19,773	24,716	27,682	29,659	31,043	39,546	59,319	29,659	8898	17796	29659
3-1/2 x 8	5-3/8"	8.959	96,000	851,432	27,068	24,833	31,042	34,767	37,250	38,988	49,667	74,500	37,250	11175	22350	37250
3-3/4 x 8	5-3/4"	10.334	96,000	982,113	33,453	30,691	38,364	42,967	46,037	48,185	61,382	92,073	46,037	13811	27622	46037
4 x 8	6-1/8"	11.807	96,000	1,122,120	40,770	37,404	46,755	52,366	56,106	58,724	74,808	112,212	56,106	16832	33664	56106
4-1/4 x 8	6-1/2"	13.378	96,000	1,271,453	49,083	45,031	56,288	63,043	67,546	70,698	90,061	135,092	67,546	20264	40528	67546
4-1/2 x 8	6-7/8"	15.047	96,000	1,430,111	58,456	53,629	67,036	75,081	80,444	84,198	107,258	160,887	80,444	24133	48266	80444
4-3/4 x 8	7-1/4"	16.815	96,000	1,598,095	68,951	63,258	79,072	88,561	94,887	99,315	126,516	189,774	94,887	28466	56932	94887
5 x 8	7-5/8"	18.681	96,000	1,775,405	80,633	73,975	92,469	103,565	110,963	116,141	147,950	221,926	110,963	33289	66578	110963
5-1/4 x 8	8"	20.644	96,000	1,962,041	93,565	85,839	107,299	120,175	128,759	134,768	171,679	257,518	128,759	38628	77255	128759
5-1/2 x 8	8-3/8"	22.706	96,000	2,158,003	107,810	98,908	123,636	138,472	148,363	155,286	197,817	296,725	148,363	44509	89018	148363
5-3/4 x 8	8-3/4"	24.866	96,000	2,363,290	123,433	113,241	141,551	158,537	169,861	177,788	226,482	339,723	169,861	50958	101917	169861
6 x 8	9-1/8"	27.124	96,000	2,577,903	140,496	128,895	161,119	180,453	193,343	202,365	257,790	386,686	193,343	58003	116006	193343

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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HYTORC

TORQUE GUIDE FOR ISO **R898** GRADE **10.9** STUD

BOLT TENSION BASED ON 40 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	136,000	18,185	124	114	142	159	170	178	227	341	170	51	102	170
7/8 x 9	1-7/16"	0.461	136,000	25,106	200	183	229	256	275	287	366	549	275	82	165	275
1x 8	1-5/8"	0.605	136,000	32,936	299	274	343	384	412	431	549	823	412	124	247	412
1-1/8 x 8	1-13/16"	0.790	136,000	42,979	439	403	504	564	604	633	806	1,209	604	181	363	604
1-1/4 x 8	2"	0.999	136,000	54,356	617	566	708	793	849	889	1,132	1,699	849	255	510	849
1-3/8 x 8	2-3/16"	1.233	136,000	67,068	838	768	961	1,076	1,153	1,207	1,537	2,305	1,153	346	692	1153
1-1/2 x 8	2-3/8"	1.491	136,000	81,115	1,105	1,014	1,267	1,420	1,521	1,592	2,028	3,042	1,521	456	913	1521
1-5/8 x 8	2-9/16"	1.774	136,000	96,496	1,424	1,307	1,633	1,829	1,960	2,052	2,613	3,920	1,960	588	1176	1960
1-3/4 x 8	2-3/4"	2.081	136,000	113,212	1,800	1,651	2,064	2,311	2,477	2,592	3,302	4,953	2,477	743	1486	2477
1-7/8 x 8	2-15/16"	2.413	136,000	131,262	2,236	2,051	2,564	2,871	3,076	3,220	4,102	6,153	3,076	923	1846	3076
2 x 8	3-1/8"	2.769	136,000	150,646	2,737	2,511	3,138	3,515	3,766	3,942	5,022	7,532	3,766	1130	2260	3766
2-1/8 x 8	3-5/16"	3.150	136,000	171,365	3,308	3,035	3,793	4,248	4,552	4,764	6,069	9,104	4,552	1366	2731	4552
2-1/4 x 8	3-1/2"	3.555	136,000	193,419	3,953	3,627	4,533	5,077	5,440	5,694	7,253	10,880	5,440	1632	3264	5440
2-3/8 x 8	3-11/16"	3.985	136,000	216,807	4,677	4,291	5,364	6,007	6,436	6,737	8,582	12,873	6,436	1931	3862	6436
2-1/2 x 8	3-7/8"	4.440	136,000	241,529	5,485	5,032	6,290	7,045	7,548	7,900	10,064	15,096	7,548	2264	4529	7548
2-3/4 x 8	4-1/4"	5.422	136,000	294,978	7,368	6,760	8,450	9,464	10,140	10,613	13,520	20,280	10,140	3042	6084	10140
3 x 8	4-5/8"	6.503	136,000	353,765	9,640	8,844	11,055	12,382	13,266	13,885	17,688	26,532	13,266	3980	7960	13266
3-1/4 x 8	5"	7.682	136,000	417,889	12,336	11,318	14,147	15,845	16,977	17,769	22,636	33,953	16,977	5093	10186	16977
3-1/2 x 8	5-3/8"	8.959	136,000	487,352	15,494	14,214	17,768	19,900	21,322	22,317	28,429	42,643	21,322	6396	12793	21322
3-3/4 x 8	5-3/4"	10.334	136,000	562,152	19,148	17,567	21,959	24,594	26,351	27,581	35,135	52,702	26,351	7905	15811	26351
4 x 8	6-1/8"	11.807	136,000	642,291	23,337	21,410	26,762	29,974	32,115	33,613	42,819	64,229	32,115	9634	19269	32115
4-1/4 x 8	6-1/2"	13.378	136,000	727,767	28,095	25,775	32,219	36,085	38,663	40,467	51,550	77,325	38,663	11599	23198	38663
4-1/2 x 8	6-7/8"	15.047	136,000	818,582	33,460	30,697	38,371	42,976	46,045	48,194	61,394	92,090	46,045	13814	27627	46045
4-3/4 x 8	7-1/4"	16.815	136,000	914,735	39,467	36,208	45,260	50,692	54,312	56,847	72,416	108,625	54,312	16294	32587	54312
5 x 8	7-5/8"	18.681	136,000	1,016,225	46,154	42,343	52,928	59,280	63,514	66,478	84,685	127,028	63,514	19054	38108	63514
5-1/4 x 8	8"	20.644	136,000	1,123,054	53,556	49,134	61,417	68,787	73,700	77,140	98,267	147,401	73,700	22110	44220	73700
5-1/2 x 8	8-3/8"	22.706	136,000	1,235,220	61,710	56,614	70,768	79,260	84,921	88,884	113,229	169,843	84,921	25476	50953	84921
5-3/4 x 8	8-3/4"	24.866	136,000	1,352,725	70,652	64,818	81,023	90,745	97,227	101,764	129,636	194,454	97,227	29168	58336	97227
6 x 8	9-1/8"	27.124	136,000	1,475,568	80,418	73,778	92,223	103,290	110,668	115,832	147,557	221,335	110,668	33200	66401	110668

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TORQUE GUIDE FOR ISO **R898** GRADE **10.9** STUD

BOLT TENSION BASED ON 50 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN²)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	136,000	22,732	155	142	178	199	213	223	284	426	213	64	128	213
7/8 x 9	1-7/16"	0.461	136,000	31,382	249	229	286	320	343	359	458	686	343	103	206	343
1x 8	1-5/8"	0.605	136,000	41,170	374	343	429	480	515	539	686	1,029	515	154	309	515
1-1/8 x 8	1-13/16"	0.790	136,000	53,724	549	504	630	705	755	791	1,007	1,511	755	227	453	755
1-1/4 x 8	2"	0.999	136,000	67,945	771	708	885	991	1,062	1,111	1,416	2,123	1,062	318	637	1062
1-3/8 x 8	2-3/16"	1.233	136,000	83,836	1,047	961	1,201	1,345	1,441	1,508	1,921	2,882	1,441	432	865	1441
1-1/2 x 8	2-3/8"	1.491	136,000	101,394	1,381	1,267	1,584	1,774	1,901	1,990	2,535	3,802	1,901	570	1141	1901
1-5/8 x 8	2-9/16"	1.774	136,000	120,620	1,780	1,633	2,042	2,287	2,450	2,564	3,267	4,900	2,450	735	1470	2450
1-3/4 x 8	2-3/4"	2.081	136,000	141,514	2,249	2,064	2,580	2,889	3,096	3,240	4,128	6,191	3,096	929	1857	3096
1-7/8 x 8	2-15/16"	2.413	136,000	164,077	2,794	2,564	3,205	3,589	3,846	4,025	5,127	7,691	3,846	1154	2307	3846
2 x 8	3-1/8"	2.769	136,000	188,308	3,421	3,138	3,923	4,394	4,708	4,927	6,277	9,415	4,708	1412	2825	4708
2-1/8 x 8	3-5/16"	3.150	136,000	214,206	4,135	3,793	4,742	5,311	5,690	5,955	7,586	11,380	5,690	1707	3414	5690
2-1/4 x 8	3-1/2"	3.555	136,000	241,773	4,941	4,533	5,667	6,347	6,800	7,117	9,067	13,600	6,800	2040	4080	6800
2-3/8 x 8	3-11/16"	3.985	136,000	271,008	5,846	5,364	6,705	7,509	8,046	8,421	10,727	16,091	8,046	2414	4827	8046
2-1/2 x 8	3-7/8"	4.440	136,000	301,912	6,856	6,290	7,862	8,806	9,435	9,875	12,580	18,869	9,435	2830	5661	9435
2-3/4 x 8	4-1/4"	5.422	136,000	368,722	9,210	8,450	10,562	11,830	12,675	13,266	16,900	25,350	12,675	3802	7605	12675
3 x 8	4-5/8"	6.503	136,000	442,206	12,050	11,055	13,819	15,477	16,583	17,357	22,110	33,165	16,583	4975	9950	16583
3-1/4 x 8	5"	7.682	136,000	522,361	15,421	14,147	17,684	19,806	21,221	22,211	28,295	42,442	21,221	6366	12733	21221
3-1/2 x 8	5-3/8"	8.959	136,000	609,190	19,367	17,768	22,210	24,875	26,652	27,896	35,536	53,304	26,652	7996	15991	26652
3-3/4 x 8	5-3/4"	10.334	136,000	702,690	23,935	21,959	27,449	30,743	32,939	34,476	43,918	65,877	32,939	9882	19763	32939
4 x 8	6-1/8"	11.807	136,000	802,864	29,171	26,762	33,453	37,467	40,143	42,017	53,524	80,286	40,143	12043	24086	40143
4-1/4 x 8	6-1/2"	13.378	136,000	909,709	35,119	32,219	40,274	45,106	48,328	50,584	64,438	96,657	48,328	14498	28997	48328
4-1/2 x 8	6-7/8"	15.047	136,000	1,023,228	41,824	38,371	47,964	53,719	57,557	60,243	76,742	115,113	57,557	17267	34534	57557
4-3/4 x 8	7-1/4"	16.815	136,000	1,143,418	49,334	45,260	56,575	63,364	67,890	71,059	90,521	135,781	67,890	20367	40734	67890
5 x 8	7-5/8"	18.681	136,000	1,270,282	57,692	52,928	66,160	74,100	79,393	83,098	105,857	158,785	79,393	23818	47636	79393
5-1/4 x 8	8"	20.644	136,000	1,403,817	66,945	61,417	76,771	85,984	92,126	96,425	122,834	184,251	92,126	27638	55275	92126
5-1/2 x 8	8-3/8"	22.706	136,000	1,544,026	77,137	70,768	88,460	99,075	106,152	111,106	141,536	212,304	106,152	31846	63691	106152
5-3/4 x 8	8-3/4"	24.866	136,000	1,690,906	88,315	81,023	101,278	113,432	121,534	127,205	162,045	243,068	121,534	36460	72920	121534
6 x 8	9-1/8"	27.124	136,000	1,844,460	100,523	92,223	115,279	129,112	138,334	144,790	184,446	276,669	138,334	41500	83001	138334

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
If 'K' factor is not listed, Enter appropriate value under Custom (insert K) , in yellow field only
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TORQUE GUIDE FOR ISO **R898** GRADE **10.9** STUD

BOLT TENSION BASED ON 60 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	136,000	27,278	186	170	213	239	256	268	341	511	256	77	153	256
7/8 x 9	1-7/16"	0.461	136,000	37,658	299	275	343	384	412	431	549	824	412	124	247	412
1x 8	1-5/8"	0.605	136,000	49,404	449	412	515	576	618	646	823	1,235	618	185	371	618
1-1/8 x 8	1-13/16"	0.790	136,000	64,468	659	604	755	846	907	949	1,209	1,813	907	272	544	907
1-1/4 x 8	2"	0.999	136,000	81,535	926	849	1,062	1,189	1,274	1,333	1,699	2,548	1,274	382	764	1274
1-3/8 x 8	2-3/16"	1.233	136,000	100,603	1,256	1,153	1,441	1,614	1,729	1,810	2,305	3,458	1,729	519	1037	1729
1-1/2 x 8	2-3/8"	1.491	136,000	121,672	1,658	1,521	1,901	2,129	2,281	2,388	3,042	4,563	2,281	684	1369	2281
1-5/8 x 8	2-9/16"	1.774	136,000	144,744	2,136	1,960	2,450	2,744	2,940	3,077	3,920	5,880	2,940	882	1764	2940
1-3/4 x 8	2-3/4"	2.081	136,000	169,817	2,699	2,477	3,096	3,467	3,715	3,888	4,953	7,430	3,715	1114	2229	3715
1-7/8 x 8	2-15/16"	2.413	136,000	196,892	3,353	3,076	3,846	4,307	4,615	4,830	6,153	9,229	4,615	1384	2769	4615
2 x 8	3-1/8"	2.769	136,000	225,969	4,105	3,766	4,708	5,273	5,649	5,913	7,532	11,298	5,649	1695	3390	5649
2-1/8 x 8	3-5/16"	3.150	136,000	257,048	4,962	4,552	5,690	6,373	6,828	7,146	9,104	13,656	6,828	2048	4097	6828
2-1/4 x 8	3-1/2"	3.555	136,000	290,128	5,929	5,440	6,800	7,616	8,160	8,541	10,880	16,320	8,160	2448	4896	8160
2-3/8 x 8	3-11/16"	3.985	136,000	325,210	7,016	6,436	8,046	9,011	9,655	10,105	12,873	19,309	9,655	2896	5793	9655
2-1/2 x 8	3-7/8"	4.440	136,000	362,294	8,227	7,548	9,435	10,567	11,322	11,850	15,096	22,643	11,322	3397	6793	11322
2-3/4 x 8	4-1/4"	5.422	136,000	442,467	11,052	10,140	12,675	14,196	15,210	15,920	20,280	30,420	15,210	4563	9126	15210
3 x 8	4-5/8"	6.503	136,000	530,647	14,460	13,266	16,583	18,573	19,899	20,828	26,532	39,799	19,899	5970	11940	19899
3-1/4 x 8	5"	7.682	136,000	626,834	18,505	16,977	21,221	23,767	25,465	26,653	33,953	50,930	25,465	7640	15279	25465
3-1/2 x 8	5-3/8"	8.959	136,000	731,028	23,241	21,322	26,652	29,850	31,982	33,475	42,643	63,965	31,982	9595	19189	31982
3-3/4 x 8	5-3/4"	10.334	136,000	843,228	28,722	26,351	32,939	36,891	39,526	41,371	52,702	79,053	39,526	11858	23716	39526
4 x 8	6-1/8"	11.807	136,000	963,436	35,005	32,115	40,143	44,960	48,172	50,420	64,229	96,344	48,172	14452	28903	48172
4-1/4 x 8	6-1/2"	13.378	136,000	1,091,651	42,142	38,663	48,328	54,128	57,994	60,700	77,325	115,988	57,994	17398	34796	57994
4-1/2 x 8	6-7/8"	15.047	136,000	1,227,873	50,189	46,045	57,557	64,463	69,068	72,291	92,090	138,136	69,068	20720	41441	69068
4-3/4 x 8	7-1/4"	16.815	136,000	1,372,102	59,200	54,312	67,890	76,037	81,469	85,270	108,625	162,937	81,469	24441	48881	81469
5 x 8	7-5/8"	18.681	136,000	1,524,338	69,230	63,514	79,393	88,920	95,271	99,717	127,028	190,542	95,271	28581	57163	95271
5-1/4 x 8	8"	20.644	136,000	1,684,581	80,333	73,700	92,126	103,181	110,551	115,710	147,401	221,101	110,551	33165	66330	110551
5-1/2 x 8	8-3/8"	22.706	136,000	1,852,831	92,564	84,921	106,152	118,890	127,382	133,327	169,843	254,764	127,382	38215	76429	127382
5-3/4 x 8	8-3/4"	24.866	136,000	2,029,088	105,978	97,227	121,534	136,118	145,841	152,647	194,454	291,681	145,841	43752	87504	145841
6 x 8	9-1/8"	27.124	136,000	2,213,351	120,628	110,668	138,334	154,935	166,001	173,748	221,335	332,003	166,001	49800	99601	166001

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TORQUE GUIDE FOR ISO **R898** GRADE **10.9** STUD

BOLT TENSION BASED ON 70 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	136,000	31,824	217	199	249	278	298	312	398	597	298	90	179	298
7/8 x 9	1-7/16"	0.461	136,000	43,935	349	320	400	449	481	503	641	961	481	144	288	481
1x 8	1-5/8"	0.605	136,000	57,638	524	480	600	672	720	754	961	1,441	720	216	432	720
1-1/8 x 8	1-13/16"	0.790	136,000	75,213	769	705	881	987	1,058	1,107	1,410	2,115	1,058	317	635	1058
1-1/4 x 8	2"	0.999	136,000	95,124	1,080	991	1,239	1,387	1,486	1,556	1,982	2,973	1,486	446	892	1486
1-3/8 x 8	2-3/16"	1.233	136,000	117,370	1,466	1,345	1,681	1,883	2,017	2,111	2,690	4,035	2,017	605	1210	2017
1-1/2 x 8	2-3/8"	1.491	136,000	141,951	1,934	1,774	2,218	2,484	2,662	2,786	3,549	5,323	2,662	798	1597	2662
1-5/8 x 8	2-9/16"	1.774	136,000	168,868	2,493	2,287	2,858	3,201	3,430	3,590	4,574	6,860	3,430	1029	2058	3430
1-3/4 x 8	2-3/4"	2.081	136,000	198,120	3,149	2,889	3,612	4,045	4,334	4,536	5,779	8,668	4,334	1300	2600	4334
1-7/8 x 8	2-15/16"	2.413	136,000	229,708	3,912	3,589	4,486	5,025	5,384	5,635	7,178	10,768	5,384	1615	3230	5384
2 x 8	3-1/8"	2.769	136,000	263,631	4,789	4,394	5,492	6,151	6,591	6,898	8,788	13,182	6,591	1977	3954	6591
2-1/8 x 8	3-5/16"	3.150	136,000	299,889	5,788	5,311	6,638	7,435	7,966	8,338	10,621	15,932	7,966	2390	4779	7966
2-1/4 x 8	3-1/2"	3.555	136,000	338,483	6,918	6,347	7,933	8,885	9,520	9,964	12,693	19,040	9,520	2856	5712	9520
2-3/8 x 8	3-11/16"	3.985	136,000	379,412	8,185	7,509	9,386	10,513	11,264	11,789	15,018	22,528	11,264	3379	6758	11264
2-1/2 x 8	3-7/8"	4.440	136,000	422,676	9,598	8,806	11,007	12,328	13,209	13,825	17,612	26,417	13,209	3963	7925	13209
2-3/4 x 8	4-1/4"	5.422	136,000	516,211	12,895	11,830	14,787	16,562	17,745	18,573	23,660	35,490	17,745	5323	10647	17745
3 x 8	4-5/8"	6.503	136,000	619,088	16,870	15,477	19,346	21,668	23,216	24,299	30,954	46,432	23,216	6965	13929	23216
3-1/4 x 8	5"	7.682	136,000	731,306	21,589	19,806	24,758	27,729	29,709	31,096	39,612	59,419	29,709	8913	17826	29709
3-1/2 x 8	5-3/8"	8.959	136,000	852,865	27,114	24,875	31,094	34,825	37,313	39,054	49,750	74,626	37,313	11194	22388	37313
3-3/4 x 8	5-3/4"	10.334	136,000	983,767	33,510	30,743	38,428	43,040	46,114	48,266	61,485	92,228	46,114	13834	27668	46114
4 x 8	6-1/8"	11.807	136,000	1,124,009	40,839	37,467	46,834	52,454	56,200	58,823	74,934	112,401	56,200	16860	33720	56200
4-1/4 x 8	6-1/2"	13.378	136,000	1,273,593	49,166	45,106	56,383	63,149	67,660	70,817	90,213	135,319	67,660	20298	40596	67660
4-1/2 x 8	6-7/8"	15.047	136,000	1,432,519	58,554	53,719	67,149	75,207	80,579	84,340	107,439	161,158	80,579	24174	48348	80579
4-3/4 x 8	7-1/4"	16.815	136,000	1,600,786	69,067	63,364	79,206	88,710	95,047	99,482	126,729	190,093	95,047	28514	57028	95047
5 x 8	7-5/8"	18.681	136,000	1,778,394	80,769	74,100	92,625	103,740	111,150	116,337	148,200	222,299	111,150	33345	66690	111150
5-1/4 x 8	8"	20.644	136,000	1,965,344	93,722	85,984	107,480	120,377	128,976	134,995	171,968	257,951	128,976	38693	77385	128976
5-1/2 x 8	8-3/8"	22.706	136,000	2,161,636	107,992	99,075	123,844	138,705	148,612	155,548	198,150	297,225	148,612	44584	89167	148612
5-3/4 x 8	8-3/4"	24.866	136,000	2,367,269	123,640	113,432	141,790	158,804	170,147	178,088	226,863	340,295	170,147	51044	102088	170147
6 x 8	9-1/8"	27.124	136,000	2,582,243	140,732	129,112	161,390	180,757	193,668	202,706	258,224	387,337	193,668	58100	116201	193668

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TORQUE GUIDE FOR ISO **R898** GRADE **10.9** STUD

BOLT TENSION BASED ON 80 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	136,000	36,371	248	227	284	318	341	357	455	682	341	102	205	341
7/8 x 9	1-7/16"	0.461	136,000	50,211	399	366	458	513	549	575	732	1,098	549	165	330	549
1x 8	1-5/8"	0.605	136,000	65,872	598	549	686	769	823	862	1,098	1,647	823	247	494	823
1-1/8 x 8	1-13/16"	0.790	136,000	85,958	878	806	1,007	1,128	1,209	1,265	1,612	2,418	1,209	363	725	1209
1-1/4 x 8	2"	0.999	136,000	108,713	1,234	1,132	1,416	1,585	1,699	1,778	2,265	3,397	1,699	510	1019	1699
1-3/8 x 8	2-3/16"	1.233	136,000	134,137	1,675	1,537	1,921	2,152	2,305	2,413	3,074	4,611	2,305	692	1383	2305
1-1/2 x 8	2-3/8"	1.491	136,000	162,230	2,210	2,028	2,535	2,839	3,042	3,184	4,056	6,084	3,042	913	1825	3042
1-5/8 x 8	2-9/16"	1.774	136,000	192,992	2,849	2,613	3,267	3,659	3,920	4,103	5,227	7,840	3,920	1176	2352	3920
1-3/4 x 8	2-3/4"	2.081	136,000	226,423	3,599	3,302	4,128	4,623	4,953	5,184	6,604	9,906	4,953	1486	2972	4953
1-7/8 x 8	2-15/16"	2.413	136,000	262,523	4,471	4,102	5,127	5,743	6,153	6,440	8,204	12,306	6,153	1846	3692	6153
2 x 8	3-1/8"	2.769	136,000	301,292	5,473	5,022	6,277	7,030	7,532	7,884	10,043	15,065	7,532	2260	4519	7532
2-1/8 x 8	3-5/16"	3.150	136,000	342,730	6,615	6,069	7,586	8,497	9,104	9,529	12,138	18,208	9,104	2731	5462	9104
2-1/4 x 8	3-1/2"	3.555	136,000	386,837	7,906	7,253	9,067	10,154	10,880	11,388	14,506	21,760	10,880	3264	6528	10880
2-3/8 x 8	3-11/16"	3.985	136,000	433,614	9,354	8,582	10,727	12,015	12,873	13,474	17,164	25,746	12,873	3862	7724	12873
2-1/2 x 8	3-7/8"	4.440	136,000	483,059	10,969	10,064	12,580	14,089	15,096	15,800	20,127	30,191	15,096	4529	9057	15096
2-3/4 x 8	4-1/4"	5.422	136,000	589,956	14,737	13,520	16,900	18,928	20,280	21,226	27,040	40,559	20,280	6084	12168	20280
3 x 8	4-5/8"	6.503	136,000	707,529	19,280	17,688	22,110	24,764	26,532	27,771	35,376	53,065	26,532	7960	15919	26532
3-1/4 x 8	5"	7.682	136,000	835,778	24,673	22,636	28,295	31,690	33,953	35,538	45,271	67,907	33,953	10186	20372	33953
3-1/2 x 8	5-3/8"	8.959	136,000	974,703	30,987	28,429	35,536	39,800	42,643	44,633	56,858	85,287	42,643	12793	25586	42643
3-3/4 x 8	5-3/4"	10.334	136,000	1,124,305	38,297	35,135	43,918	49,188	52,702	55,161	70,269	105,404	52,702	15811	31621	52702
4 x 8	6-1/8"	11.807	136,000	1,284,582	46,673	42,819	53,524	59,947	64,229	67,226	85,639	128,458	64,229	19269	38537	64229
4-1/4 x 8	6-1/2"	13.378	136,000	1,455,535	56,190	51,550	64,438	72,170	77,325	80,934	103,100	154,651	77,325	23198	46395	77325
4-1/2 x 8	6-7/8"	15.047	136,000	1,637,164	66,919	61,394	76,742	85,951	92,090	96,388	122,787	184,181	92,090	27627	55254	92090
4-3/4 x 8	7-1/4"	16.815	136,000	1,829,469	78,934	72,416	90,521	101,383	108,625	113,694	144,833	217,249	108,625	32587	65175	108625
5 x 8	7-5/8"	18.681	136,000	2,032,451	92,307	84,685	105,857	118,560	127,028	132,956	169,371	254,056	127,028	38108	76217	127028
5-1/4 x 8	8"	20.644	136,000	2,246,108	107,111	98,267	122,834	137,574	147,401	154,280	196,534	294,802	147,401	44220	88440	147401
5-1/2 x 8	8-3/8"	22.706	136,000	2,470,441	123,419	113,229	141,536	158,520	169,843	177,769	226,457	339,686	169,843	50953	101906	169843
5-3/4 x 8	8-3/4"	24.866	136,000	2,705,450	141,303	129,636	162,045	181,491	194,454	203,529	259,272	388,908	194,454	58336	116673	194454
6 x 8	9-1/8"	27.124	136,000	2,951,135	160,837	147,557	184,446	206,579	221,335	231,664	295,114	442,670	221,335	66401	132801	221335

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

REV 7.31.09

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To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
If 'K' factor is not listed, Enter appropriate value under Custom (insert K) , in yellow field only
as always- after entering any value, click outside the field or hit enter to update calculations.
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TORQUE GUIDE FOR ISO **R898** GRADE **10.9** STUD BOLT TENSION BASED ON 90 % YIELD					REQUIRED TORQUE (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	136,000	40,917	279	256	320	358	384	401	511	767	384	115	230	384
7/8 x 9	1-7/16"	0.461	136,000	56,487	449	412	515	577	618	647	824	1,236	618	185	371	618
1x 8	1-5/8"	0.605	136,000	74,105	673	618	772	865	926	970	1,235	1,853	926	278	556	926
1-1/8 x 8	1-13/16"	0.790	136,000	96,702	988	907	1,133	1,269	1,360	1,423	1,813	2,720	1,360	408	816	1360
1-1/4 x 8	2"	0.999	136,000	122,302	1,389	1,274	1,592	1,784	1,911	2,000	2,548	3,822	1,911	573	1147	1911
1-3/8 x 8	2-3/16"	1.233	136,000	150,904	1,885	1,729	2,161	2,421	2,594	2,715	3,458	5,187	2,594	778	1556	2594
1-1/2 x 8	2-3/8"	1.491	136,000	182,509	2,487	2,281	2,852	3,194	3,422	3,582	4,563	6,844	3,422	1027	2053	3422
1-5/8 x 8	2-9/16"	1.774	136,000	217,116	3,205	2,940	3,675	4,116	4,410	4,616	5,880	8,820	4,410	1323	2646	4410
1-3/4 x 8	2-3/4"	2.081	136,000	254,726	4,049	3,715	4,643	5,201	5,572	5,832	7,430	11,144	5,572	1672	3343	5572
1-7/8 x 8	2-15/16"	2.413	136,000	295,339	5,030	4,615	5,768	6,461	6,922	7,245	9,229	13,844	6,922	2077	4153	6922
2 x 8	3-1/8"	2.769	136,000	338,954	6,158	5,649	7,062	7,909	8,474	8,869	11,298	16,948	8,474	2542	5084	8474
2-1/8 x 8	3-5/16"	3.150	136,000	385,572	7,442	6,828	8,535	9,559	10,242	10,720	13,656	20,483	10,242	3073	6145	10242
2-1/4 x 8	3-1/2"	3.555	136,000	435,192	8,894	8,160	10,200	11,424	12,240	12,811	16,320	24,480	12,240	3672	7344	12240
2-3/8 x 8	3-11/16"	3.985	136,000	487,815	10,524	9,655	12,068	13,517	14,482	15,158	19,309	28,964	14,482	4345	8689	14482
2-1/2 x 8	3-7/8"	4.440	136,000	543,441	12,341	11,322	14,152	15,850	16,983	17,775	22,643	33,965	16,983	5095	10190	16983
2-3/4 x 8	4-1/4"	5.422	136,000	663,700	16,579	15,210	19,012	21,294	22,815	23,879	30,420	45,629	22,815	6844	13689	22815
3 x 8	4-5/8"	6.503	136,000	795,970	21,690	19,899	24,874	27,859	29,849	31,242	39,799	59,698	29,849	8955	17909	29849
3-1/4 x 8	5"	7.682	136,000	940,250	27,757	25,465	31,831	35,651	38,198	39,980	50,930	76,395	38,198	11459	22919	38198
3-1/2 x 8	5-3/8"	8.959	136,000	1,096,541	34,861	31,982	39,978	44,775	47,974	50,212	63,965	95,947	47,974	14392	28784	47974
3-3/4 x 8	5-3/4"	10.334	136,000	1,264,843	43,084	39,526	49,408	55,337	59,289	62,056	79,053	118,579	59,289	17787	35574	59289
4 x 8	6-1/8"	11.807	136,000	1,445,154	52,507	48,172	60,215	67,441	72,258	75,630	96,344	144,515	72,258	21677	43355	72258
4-1/4 x 8	6-1/2"	13.378	136,000	1,637,477	63,213	57,994	72,492	81,192	86,991	91,051	115,988	173,982	86,991	26097	52195	86991
4-1/2 x 8	6-7/8"	15.047	136,000	1,841,810	75,284	69,068	86,335	96,695	103,602	108,437	138,136	207,204	103,602	31081	62161	103602
4-3/4 x 8	7-1/4"	16.815	136,000	2,058,153	88,801	81,469	101,836	114,056	122,203	127,906	162,937	244,406	122,203	36661	73322	122203
5 x 8	7-5/8"	18.681	136,000	2,286,507	103,846	95,271	119,089	133,380	142,907	149,576	190,542	285,813	142,907	42872	85744	142907
5-1/4 x 8	8"	20.644	136,000	2,526,871	120,500	110,551	138,188	154,771	165,826	173,564	221,101	331,652	165,826	49748	99496	165826
5-1/2 x 8	8-3/8"	22.706	136,000	2,779,246	138,846	127,382	159,228	178,335	191,073	199,990	254,764	382,146	191,073	57322	114644	191073
5-3/4 x 8	8-3/4"	24.866	136,000	3,043,631	158,966	145,841	182,301	204,177	218,761	228,970	291,681	437,522	218,761	65628	131257	218761
6 x 8	9-1/8"	27.124	136,000	3,320,027	180,941	166,001	207,502	232,402	249,002	260,622	332,003	498,004	249,002	74701	149401	249002

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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TORQUE GUIDE FOR ISO **R898** GRADE **10.9** STUD

BOLT TENSION BASED ON 99 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	136,000	45,009	307	281	352	394	422	442	563	844	422	127	253	422
7/8 x 9	1-7/16"	0.461	136,000	62,136	494	453	566	634	680	711	906	1,359	680	204	408	680
1x 8	1-5/8"	0.605	136,000	81,516	740	679	849	951	1,019	1,067	1,359	2,038	1,019	306	611	1019
1-1/8 x 8	1-13/16"	0.790	136,000	106,373	1,087	997	1,247	1,396	1,496	1,566	1,994	2,992	1,496	449	898	1496
1-1/4 x 8	2"	0.999	136,000	134,532	1,527	1,401	1,752	1,962	2,102	2,200	2,803	4,204	2,102	631	1261	2102
1-3/8 x 8	2-3/16"	1.233	136,000	165,994	2,073	1,902	2,378	2,663	2,853	2,986	3,804	5,706	2,853	856	1712	2853
1-1/2 x 8	2-3/8"	1.491	136,000	200,760	2,735	2,509	3,137	3,513	3,764	3,940	5,019	7,528	3,764	1129	2259	3764
1-5/8 x 8	2-9/16"	1.774	136,000	238,828	3,525	3,234	4,043	4,528	4,851	5,078	6,468	9,702	4,851	1455	2911	4851
1-3/4 x 8	2-3/4"	2.081	136,000	280,199	4,454	4,086	5,108	5,721	6,129	6,415	8,172	12,259	6,129	1839	3678	6129
1-7/8 x 8	2-15/16"	2.413	136,000	324,872	5,533	5,076	6,345	7,107	7,614	7,970	10,152	15,228	7,614	2284	4569	7614
2 x 8	3-1/8"	2.769	136,000	372,849	6,773	6,214	7,768	8,700	9,321	9,756	12,428	18,642	9,321	2796	5593	9321
2-1/8 x 8	3-5/16"	3.150	136,000	424,129	8,187	7,511	9,388	10,515	11,266	11,792	15,021	22,532	11,266	3380	6760	11266
2-1/4 x 8	3-1/2"	3.555	136,000	478,711	9,784	8,976	11,220	12,566	13,464	14,092	17,952	26,928	13,464	4039	8078	13464
2-3/8 x 8	3-11/16"	3.985	136,000	536,597	11,576	10,620	13,275	14,868	15,930	16,674	21,240	31,860	15,930	4779	9558	15930
2-1/2 x 8	3-7/8"	4.440	136,000	597,785	13,575	12,454	15,567	17,435	18,681	19,553	24,908	37,362	18,681	5604	11208	18681
2-3/4 x 8	4-1/4"	5.422	136,000	730,070	18,237	16,731	20,913	23,423	25,096	26,267	33,462	50,192	25,096	7529	15058	25096
3 x 8	4-5/8"	6.503	136,000	875,567	23,859	21,889	27,361	30,645	32,834	34,366	43,778	65,668	32,834	9850	19700	32834
3-1/4 x 8	5"	7.682	136,000	1,034,276	30,533	28,012	35,015	39,216	42,017	43,978	56,023	84,035	42,017	12605	25210	42017
3-1/2 x 8	5-3/8"	8.959	136,000	1,206,195	38,347	35,181	43,976	49,253	52,771	55,234	70,361	105,542	52,771	15831	31663	52771
3-3/4 x 8	5-3/4"	10.334	136,000	1,391,327	47,392	43,479	54,349	60,871	65,218	68,262	86,958	130,437	65,218	19566	39131	65218
4 x 8	6-1/8"	11.807	136,000	1,589,670	57,758	52,989	66,236	74,185	79,483	83,193	105,978	158,967	79,483	23845	47690	79483
4-1/4 x 8	6-1/2"	13.378	136,000	1,801,225	69,535	63,793	79,742	89,311	95,690	100,156	127,587	191,380	95,690	28707	57414	95690
4-1/2 x 8	6-7/8"	15.047	136,000	2,025,991	82,812	75,975	94,968	106,365	113,962	119,280	151,949	227,924	113,962	34189	68377	113962
4-3/4 x 8	7-1/4"	16.815	136,000	2,263,968	97,681	89,615	112,019	125,462	134,423	140,696	179,231	268,846	134,423	40327	80654	134423
5 x 8	7-5/8"	18.681	136,000	2,515,158	114,230	104,798	130,998	146,718	157,197	164,533	209,596	314,395	157,197	47159	94318	157197
5-1/4 x 8	8"	20.644	136,000	2,779,558	132,550	121,606	152,007	170,248	182,409	190,921	243,211	364,817	182,409	54723	109445	182409
5-1/2 x 8	8-3/8"	22.706	136,000	3,057,171	152,731	140,120	175,150	196,168	210,180	219,989	280,241	420,361	210,180	63054	126108	210180
5-3/4 x 8	8-3/4"	24.866	136,000	3,347,994	174,863	160,425	200,531	224,595	240,637	251,867	320,849	481,274	240,637	72191	144382	240637
6 x 8	9-1/8"	27.124	136,000	3,652,030	199,036	182,601	228,252	255,642	273,902	286,684	365,203	547,804	273,902	82171	164341	273902

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TORQUE GUIDE FOR ISO **R898** GRADE **12.9** STUD BOLT TENSION BASED ON 40 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.15	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	160,000	21,395	146	134	167	187	201	210	267	401	201	60	120	201
7/8 x 9	1-7/16"	0.461	160,000	29,536	235	215	269	302	323	338	431	646	323	97	194	323
1x 8	1-5/8"	0.605	160,000	38,748	352	323	404	452	484	507	646	969	484	145	291	484
1-1/8 x 8	1-13/16"	0.790	160,000	50,563	517	474	593	664	711	744	948	1,422	711	213	427	711
1-1/4 x 8	2"	0.999	160,000	63,949	726	666	833	933	999	1,046	1,332	1,998	999	300	600	999
1-3/8 x 8	2-3/16"	1.233	160,000	78,904	985	904	1,130	1,266	1,356	1,419	1,808	2,712	1,356	407	814	1356
1-1/2 x 8	2-3/8"	1.491	160,000	95,429	1,300	1,193	1,491	1,670	1,789	1,873	2,386	3,579	1,789	537	1074	1789
1-5/8 x 8	2-9/16"	1.774	160,000	113,525	1,676	1,537	1,922	2,152	2,306	2,414	3,075	4,612	2,306	692	1384	2306
1-3/4 x 8	2-3/4"	2.081	160,000	133,190	2,117	1,942	2,428	2,719	2,914	3,049	3,885	5,827	2,914	874	1748	2914
1-7/8 x 8	2-15/16"	2.413	160,000	154,425	2,630	2,413	3,016	3,378	3,619	3,788	4,826	7,239	3,619	1086	2172	3619
2 x 8	3-1/8"	2.769	160,000	177,231	3,220	2,954	3,692	4,135	4,431	4,638	5,908	8,862	4,431	1329	2658	4431
2-1/8 x 8	3-5/16"	3.150	160,000	201,606	3,891	3,570	4,463	4,998	5,355	5,605	7,140	10,710	5,355	1607	3213	5355
2-1/4 x 8	3-1/2"	3.555	160,000	227,551	4,651	4,267	5,333	5,973	6,400	6,699	8,533	12,800	6,400	1920	3840	6400
2-3/8 x 8	3-11/16"	3.985	160,000	255,067	5,503	5,048	6,310	7,067	7,572	7,926	10,096	15,145	7,572	2272	4543	7572
2-1/2 x 8	3-7/8"	4.440	160,000	284,152	6,453	5,920	7,400	8,288	8,880	9,294	11,840	17,760	8,880	2664	5328	8880
2-3/4 x 8	4-1/4"	5.422	160,000	347,033	8,669	7,953	9,941	11,134	11,929	12,486	15,906	23,859	11,929	3579	7158	11929
3 x 8	4-5/8"	6.503	160,000	416,194	11,341	10,405	13,006	14,567	15,607	16,336	20,810	31,215	15,607	4682	9364	15607
3-1/4 x 8	5"	7.682	160,000	491,634	14,513	13,315	16,644	18,641	19,973	20,905	26,630	39,945	19,973	5992	11984	19973
3-1/2 x 8	5-3/8"	8.959	160,000	573,355	18,228	16,723	20,904	23,412	25,084	26,255	33,446	50,169	25,084	7525	15051	25084
3-3/4 x 8	5-3/4"	10.334	160,000	661,356	22,527	20,667	25,834	28,934	31,001	32,448	41,335	62,002	31,001	9300	18601	31001
4 x 8	6-1/8"	11.807	160,000	755,636	27,455	25,188	31,485	35,263	37,782	39,545	50,376	75,564	37,782	11335	22669	37782
4-1/4 x 8	6-1/2"	13.378	160,000	856,197	33,053	30,324	37,905	42,453	45,485	47,608	60,647	90,971	45,485	13646	27291	45485
4-1/2 x 8	6-7/8"	15.047	160,000	963,038	39,364	36,114	45,142	50,559	54,171	56,699	72,228	108,342	54,171	16251	32503	54171
4-3/4 x 8	7-1/4"	16.815	160,000	1,076,158	46,432	42,598	53,247	59,637	63,897	66,879	85,196	127,794	63,897	19169	38338	63897
5 x 8	7-5/8"	18.681	160,000	1,195,559	54,298	49,815	62,269	69,741	74,722	78,209	99,630	149,445	74,722	22417	44833	74722
5-1/4 x 8	8"	20.644	160,000	1,321,240	63,007	57,804	72,255	80,926	86,706	90,753	115,608	173,413	86,706	26012	52024	86706
5-1/2 x 8	8-3/8"	22.706	160,000	1,453,201	72,599	66,605	83,256	93,247	99,908	104,570	133,210	199,815	99,908	29972	59945	99908
5-3/4 x 8	8-3/4"	24.866	160,000	1,591,441	83,120	76,257	95,321	106,759	114,385	119,723	152,513	228,770	114,385	34315	68631	114385
6 x 8	9-1/8"	27.124	160,000	1,735,962	94,610	86,798	108,498	121,517	130,197	136,273	173,596	260,394	130,197	39059	78118	130197

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
If 'K' factor is not listed, Enter appropriate value under Custom (insert K) , in yellow field only
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TORQUE GUIDE FOR ISO **R898** GRADE **12.9** STUD BOLT TENSION BASED ON 50 % YIELD					REQUIRED TORQUE (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.15	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	160,000	26,743	182	167	209	234	251	262	334	501	251	75	150	251
7/8 x 9	1-7/16"	0.461	160,000	36,920	293	269	337	377	404	423	538	808	404	121	242	404
1x 8	1-5/8"	0.605	160,000	48,435	440	404	505	565	605	634	807	1,211	605	182	363	605
1-1/8 x 8	1-13/16"	0.790	160,000	63,204	646	593	741	830	889	930	1,185	1,778	889	267	533	889
1-1/4 x 8	2"	0.999	160,000	79,936	908	833	1,041	1,166	1,249	1,307	1,665	2,498	1,249	375	749	1249
1-3/8 x 8	2-3/16"	1.233	160,000	98,630	1,232	1,130	1,413	1,582	1,695	1,774	2,260	3,390	1,695	509	1017	1695
1-1/2 x 8	2-3/8"	1.491	160,000	119,287	1,625	1,491	1,864	2,088	2,237	2,341	2,982	4,473	2,237	671	1342	2237
1-5/8 x 8	2-9/16"	1.774	160,000	141,906	2,095	1,922	2,402	2,690	2,882	3,017	3,843	5,765	2,882	865	1729	2882
1-3/4 x 8	2-3/4"	2.081	160,000	166,488	2,646	2,428	3,035	3,399	3,642	3,812	4,856	7,284	3,642	1093	2185	3642
1-7/8 x 8	2-15/16"	2.413	160,000	193,032	3,288	3,016	3,770	4,223	4,524	4,735	6,032	9,048	4,524	1357	2715	4524
2 x 8	3-1/8"	2.769	160,000	221,538	4,025	3,692	4,615	5,169	5,538	5,797	7,385	11,077	5,538	1662	3323	5538
2-1/8 x 8	3-5/16"	3.150	160,000	252,008	4,864	4,463	5,578	6,248	6,694	7,006	8,925	13,388	6,694	2008	4016	6694
2-1/4 x 8	3-1/2"	3.555	160,000	284,439	5,813	5,333	6,667	7,467	8,000	8,373	10,666	16,000	8,000	2400	4800	8000
2-3/8 x 8	3-11/16"	3.985	160,000	318,834	6,878	6,310	7,888	8,834	9,465	9,907	12,620	18,931	9,465	2840	5679	9465
2-1/2 x 8	3-7/8"	4.440	160,000	355,190	8,066	7,400	9,250	10,360	11,100	11,618	14,800	22,199	11,100	3330	6660	11100
2-3/4 x 8	4-1/4"	5.422	160,000	433,791	10,836	9,941	12,426	13,917	14,912	15,607	19,882	29,823	14,912	4473	8947	14912
3 x 8	4-5/8"	6.503	160,000	520,242	14,177	13,006	16,258	18,208	19,509	20,419	26,012	39,018	19,509	5853	11705	19509
3-1/4 x 8	5"	7.682	160,000	614,543	18,142	16,644	20,805	23,301	24,966	26,131	33,288	49,932	24,966	7490	14979	24966
3-1/2 x 8	5-3/8"	8.959	160,000	716,694	22,785	20,904	26,129	29,265	31,355	32,819	41,807	62,711	31,355	9407	18813	31355
3-3/4 x 8	5-3/4"	10.334	160,000	826,695	28,159	25,834	32,293	36,168	38,751	40,560	51,668	77,503	38,751	11625	23251	38751
4 x 8	6-1/8"	11.807	160,000	944,545	34,318	31,485	39,356	44,079	47,227	49,431	62,970	94,455	47,227	14168	28336	47227
4-1/4 x 8	6-1/2"	13.378	160,000	1,070,246	41,316	37,905	47,381	53,066	56,857	59,510	75,809	113,714	56,857	17057	34114	56857
4-1/2 x 8	6-7/8"	15.047	160,000	1,203,797	49,205	45,142	56,428	63,199	67,714	70,874	90,285	135,427	67,714	20314	40628	67714
4-3/4 x 8	7-1/4"	16.815	160,000	1,345,198	58,040	53,247	66,559	74,546	79,871	83,598	106,495	159,742	79,871	23961	47923	79871
5 x 8	7-5/8"	18.681	160,000	1,494,449	67,873	62,269	77,836	87,176	93,403	97,762	124,537	186,806	93,403	28021	56042	93403
5-1/4 x 8	8"	20.644	160,000	1,651,550	78,758	72,255	90,319	101,157	108,383	113,441	144,511	216,766	108,383	32515	65030	108383
5-1/2 x 8	8-3/8"	22.706	160,000	1,816,501	90,749	83,256	104,070	116,559	124,884	130,712	166,513	249,769	124,884	37465	74931	124884
5-3/4 x 8	8-3/4"	24.866	160,000	1,989,302	103,900	95,321	119,151	133,449	142,981	149,653	190,641	285,962	142,981	42894	85789	142981
6 x 8	9-1/8"	27.124	160,000	2,169,952	118,262	108,498	135,622	151,897	162,746	170,341	216,995	325,493	162,746	48824	97648	162746

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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HYTORC

TORQUE GUIDE FOR ISO **R898** GRADE **12.9** STUD

BOLT TENSION BASED ON 60 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.15	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	160,000	32,092	219	201	251	281	301	315	401	602	301	90	181	301
7/8 x 9	1-7/16"	0.461	160,000	44,304	352	323	404	452	485	507	646	969	485	145	291	485
1x 8	1-5/8"	0.605	160,000	58,122	528	484	605	678	727	760	969	1,453	727	218	436	727
1-1/8 x 8	1-13/16"	0.790	160,000	75,845	775	711	889	995	1,067	1,116	1,422	2,133	1,067	320	640	1067
1-1/4 x 8	2"	0.999	160,000	95,923	1,089	999	1,249	1,399	1,499	1,569	1,998	2,998	1,499	450	899	1499
1-3/8 x 8	2-3/16"	1.233	160,000	118,356	1,478	1,356	1,695	1,899	2,034	2,129	2,712	4,068	2,034	610	1221	2034
1-1/2 x 8	2-3/8"	1.491	160,000	143,144	1,950	1,789	2,237	2,505	2,684	2,809	3,579	5,368	2,684	805	1610	2684
1-5/8 x 8	2-9/16"	1.774	160,000	170,287	2,514	2,306	2,882	3,228	3,459	3,620	4,612	6,918	3,459	1038	2075	3459
1-3/4 x 8	2-3/4"	2.081	160,000	199,785	3,176	2,914	3,642	4,079	4,370	4,574	5,827	8,741	4,370	1311	2622	4370
1-7/8 x 8	2-15/16"	2.413	160,000	231,638	3,945	3,619	4,524	5,067	5,429	5,682	7,239	10,858	5,429	1629	3257	5429
2 x 8	3-1/8"	2.769	160,000	265,846	4,830	4,431	5,538	6,203	6,646	6,956	8,862	13,292	6,646	1994	3988	6646
2-1/8 x 8	3-5/16"	3.150	160,000	302,409	5,837	5,355	6,694	7,497	8,033	8,408	10,710	16,065	8,033	2410	4820	8033
2-1/4 x 8	3-1/2"	3.555	160,000	341,327	6,976	6,400	8,000	8,960	9,600	10,048	12,800	19,200	9,600	2880	5760	9600
2-3/8 x 8	3-11/16"	3.985	160,000	382,600	8,254	7,572	9,465	10,601	11,358	11,889	15,145	22,717	11,358	3408	6815	11358
2-1/2 x 8	3-7/8"	4.440	160,000	426,228	9,679	8,880	11,100	12,432	13,320	13,941	17,760	26,639	13,320	3996	7992	13320
2-3/4 x 8	4-1/4"	5.422	160,000	520,549	13,003	11,929	14,912	16,701	17,894	18,729	23,859	35,788	17,894	5368	10736	17894
3 x 8	4-5/8"	6.503	160,000	624,290	17,012	15,607	19,509	21,850	23,411	24,503	31,215	46,822	23,411	7023	14047	23411
3-1/4 x 8	5"	7.682	160,000	737,451	21,770	19,973	24,966	27,962	29,959	31,357	39,945	59,918	29,959	8988	17975	29959
3-1/2 x 8	5-3/8"	8.959	160,000	860,032	27,342	25,084	31,355	35,118	37,626	39,382	50,169	75,253	37,626	11288	22576	37626
3-3/4 x 8	5-3/4"	10.334	160,000	992,033	33,791	31,001	38,751	43,401	46,502	48,672	62,002	93,003	46,502	13950	27901	46502
4 x 8	6-1/8"	11.807	160,000	1,133,455	41,182	37,782	47,227	52,895	56,673	59,317	75,564	113,345	56,673	17002	34004	56673
4-1/4 x 8	6-1/2"	13.378	160,000	1,284,296	49,579	45,485	56,857	63,680	68,228	71,412	90,971	136,456	68,228	20468	40937	68228
4-1/2 x 8	6-7/8"	15.047	160,000	1,444,557	59,046	54,171	67,714	75,839	81,256	85,048	108,342	162,513	81,256	24377	48754	81256
4-3/4 x 8	7-1/4"	16.815	160,000	1,614,238	69,648	63,897	79,871	89,456	95,845	100,318	127,794	191,691	95,845	28754	57507	95845
5 x 8	7-5/8"	18.681	160,000	1,793,339	81,447	74,722	93,403	104,611	112,084	117,314	149,445	224,167	112,084	33625	67250	112084
5-1/4 x 8	8"	20.644	160,000	1,981,860	94,510	86,706	108,383	121,389	130,060	136,129	173,413	260,119	130,060	39018	78036	130060
5-1/2 x 8	8-3/8"	22.706	160,000	2,179,801	108,899	99,908	124,884	139,871	149,861	156,855	199,815	299,723	149,861	44958	89917	149861
5-3/4 x 8	8-3/4"	24.866	160,000	2,387,162	124,679	114,385	142,981	160,139	171,577	179,584	228,770	343,155	171,577	51473	102946	171577
6 x 8	9-1/8"	27.124	160,000	2,603,943	141,915	130,197	162,746	182,276	195,296	204,410	260,394	390,591	195,296	58589	117177	195296

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TORQUE GUIDE FOR ISO **R898** GRADE **12.9** STUD

BOLT TENSION BASED ON 70 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.15	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 0.15	First Pass 30%	Second Pass 60%	All Subsequent Passes 100%
3/4 x 10	1-1/4"	0.334	160,000	37,441	255	234	293	328	351	367	468	702	351	105	211	351
7/8 x 9	1-7/16"	0.461	160,000	51,688	411	377	471	528	565	592	754	1,131	565	170	339	565
1x 8	1-5/8"	0.605	160,000	67,809	616	565	706	791	848	887	1,130	1,695	848	254	509	848
1-1/8 x 8	1-13/16"	0.790	160,000	88,486	904	830	1,037	1,161	1,244	1,302	1,659	2,489	1,244	373	747	1244
1-1/4 x 8	2"	0.999	160,000	111,910	1,271	1,166	1,457	1,632	1,749	1,830	2,331	3,497	1,749	525	1049	1749
1-3/8 x 8	2-3/16"	1.233	160,000	138,082	1,725	1,582	1,978	2,215	2,373	2,484	3,164	4,747	2,373	712	1424	2373
1-1/2 x 8	2-3/8"	1.491	160,000	167,001	2,275	2,088	2,609	2,923	3,131	3,277	4,175	6,263	3,131	939	1879	3131
1-5/8 x 8	2-9/16"	1.774	160,000	198,668	2,932	2,690	3,363	3,766	4,035	4,224	5,381	8,071	4,035	1211	2421	4035
1-3/4 x 8	2-3/4"	2.081	160,000	233,083	3,705	3,399	4,249	4,759	5,099	5,337	6,798	10,197	5,099	1530	3059	5099
1-7/8 x 8	2-15/16"	2.413	160,000	270,244	4,603	4,223	5,278	5,912	6,334	6,629	8,445	12,668	6,334	1900	3800	6334
2 x 8	3-1/8"	2.769	160,000	310,154	5,634	5,169	6,462	7,237	7,754	8,116	10,338	15,508	7,754	2326	4652	7754
2-1/8 x 8	3-5/16"	3.150	160,000	352,811	6,810	6,248	7,810	8,747	9,372	9,809	12,495	18,743	9,372	2811	5623	9372
2-1/4 x 8	3-1/2"	3.555	160,000	398,215	8,139	7,467	9,333	10,453	11,200	11,722	14,933	22,400	11,200	3360	6720	11200
2-3/8 x 8	3-11/16"	3.985	160,000	446,367	9,629	8,834	11,043	12,368	13,252	13,870	17,669	26,503	13,252	3975	7951	13252
2-1/2 x 8	3-7/8"	4.440	160,000	497,266	11,292	10,360	12,950	14,504	15,540	16,265	20,719	31,079	15,540	4662	9324	15540
2-3/4 x 8	4-1/4"	5.422	160,000	607,307	15,170	13,917	17,397	19,484	20,876	21,850	27,835	41,752	20,876	6263	12526	20876
3 x 8	4-5/8"	6.503	160,000	728,339	19,847	18,208	22,761	25,492	27,313	28,587	36,417	54,625	27,313	8194	16388	27313
3-1/4 x 8	5"	7.682	160,000	860,360	25,399	23,301	29,127	32,622	34,952	36,583	46,603	69,904	34,952	10486	20971	34952
3-1/2 x 8	5-3/8"	8.959	160,000	1,003,371	31,899	29,265	36,581	40,971	43,897	45,946	58,530	87,795	43,897	13169	26338	43897
3-3/4 x 8	5-3/4"	10.334	160,000	1,157,372	39,423	36,168	45,210	50,635	54,252	56,784	72,336	108,504	54,252	16276	32551	54252
4 x 8	6-1/8"	11.807	160,000	1,322,364	48,046	44,079	55,098	61,710	66,118	69,204	88,158	132,236	66,118	19835	39671	66118
4-1/4 x 8	6-1/2"	13.378	160,000	1,498,345	57,842	53,066	66,333	74,293	79,600	83,314	106,133	159,199	79,600	23880	47760	79600
4-1/2 x 8	6-7/8"	15.047	160,000	1,685,316	68,887	63,199	78,999	88,479	94,799	99,223	126,399	189,598	94,799	28440	56879	94799
4-3/4 x 8	7-1/4"	16.815	160,000	1,883,277	81,256	74,546	93,183	104,365	111,820	117,038	149,093	223,639	111,820	33546	67092	111820
5 x 8	7-5/8"	18.681	160,000	2,092,228	95,022	87,176	108,970	122,047	130,764	136,867	174,352	261,529	130,764	39229	78459	130764
5-1/4 x 8	8"	20.644	160,000	2,312,170	110,262	101,157	126,447	141,620	151,736	158,817	202,315	303,472	151,736	45521	91042	151736
5-1/2 x 8	8-3/8"	22.706	160,000	2,543,101	127,049	116,559	145,698	163,182	174,838	182,997	233,118	349,676	174,838	52451	104903	174838
5-3/4 x 8	8-3/4"	24.866	160,000	2,785,022	145,459	133,449	166,811	186,829	200,173	209,515	266,898	400,347	200,173	60052	120104	200173
6 x 8	9-1/8"	27.124	160,000	3,037,933	165,567	151,897	189,871	212,655	227,845	238,478	303,793	455,690	227,845	68354	136707	227845

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
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HYTORC

TORQUE GUIDE FOR ISO **R898** GRADE **12.9** STUD

BOLT TENSION BASED ON 80 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.15	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	160,000	42,789	292	267	334	374	401	420	535	802	401	120	241	401
7/8 x 9	1-7/16"	0.461	160,000	59,072	469	431	538	603	646	676	861	1,292	646	194	388	646
1x 8	1-5/8"	0.605	160,000	77,496	704	646	807	904	969	1,014	1,292	1,937	969	291	581	969
1-1/8 x 8	1-13/16"	0.790	160,000	101,127	1,033	948	1,185	1,327	1,422	1,488	1,896	2,844	1,422	427	853	1422
1-1/4 x 8	2"	0.999	160,000	127,897	1,452	1,332	1,665	1,865	1,998	2,092	2,665	3,997	1,998	600	1199	1998
1-3/8 x 8	2-3/16"	1.233	160,000	157,808	1,971	1,808	2,260	2,532	2,712	2,839	3,616	5,425	2,712	814	1627	2712
1-1/2 x 8	2-3/8"	1.491	160,000	190,859	2,600	2,386	2,982	3,340	3,579	3,746	4,771	7,157	3,579	1074	2147	3579
1-5/8 x 8	2-9/16"	1.774	160,000	227,049	3,351	3,075	3,843	4,304	4,612	4,827	6,149	9,224	4,612	1384	2767	4612
1-3/4 x 8	2-3/4"	2.081	160,000	266,380	4,234	3,885	4,856	5,439	5,827	6,099	7,769	11,654	5,827	1748	3496	5827
1-7/8 x 8	2-15/16"	2.413	160,000	308,851	5,260	4,826	6,032	6,756	7,239	7,576	9,652	14,477	7,239	2172	4343	7239
2 x 8	3-1/8"	2.769	160,000	354,462	6,439	5,908	7,385	8,271	8,862	9,275	11,815	17,723	8,862	2658	5317	8862
2-1/8 x 8	3-5/16"	3.150	160,000	403,212	7,783	7,140	8,925	9,996	10,710	11,210	14,280	21,421	10,710	3213	6426	10710
2-1/4 x 8	3-1/2"	3.555	160,000	455,103	9,301	8,533	10,666	11,946	12,800	13,397	17,066	25,600	12,800	3840	7680	12800
2-3/8 x 8	3-11/16"	3.985	160,000	510,134	11,005	10,096	12,620	14,135	15,145	15,851	20,193	30,289	15,145	4543	9087	15145
2-1/2 x 8	3-7/8"	4.440	160,000	568,304	12,905	11,840	14,800	16,576	17,760	18,588	23,679	35,519	17,760	5328	10656	17760
2-3/4 x 8	4-1/4"	5.422	160,000	694,066	17,337	15,906	19,882	22,268	23,859	24,972	31,811	47,717	23,859	7158	14315	23859
3 x 8	4-5/8"	6.503	160,000	832,387	22,683	20,810	26,012	29,134	31,215	32,671	41,619	62,429	31,215	9364	18729	31215
3-1/4 x 8	5"	7.682	160,000	983,268	29,027	26,630	33,288	37,282	39,945	41,809	53,260	79,891	39,945	11984	23967	39945
3-1/2 x 8	5-3/8"	8.959	160,000	1,146,710	36,456	33,446	41,807	46,824	50,169	52,510	66,891	100,337	50,169	15051	30101	50169
3-3/4 x 8	5-3/4"	10.334	160,000	1,322,711	45,055	41,335	51,668	57,869	62,002	64,896	82,669	124,004	62,002	18601	37201	62002
4 x 8	6-1/8"	11.807	160,000	1,511,273	54,910	50,376	62,970	70,526	75,564	79,090	100,752	151,127	75,564	22669	45338	75564
4-1/4 x 8	6-1/2"	13.378	160,000	1,712,394	66,106	60,647	75,809	84,906	90,971	95,216	121,295	181,942	90,971	27291	54583	90971
4-1/2 x 8	6-7/8"	15.047	160,000	1,926,075	78,728	72,228	90,285	101,119	108,342	113,398	144,456	216,683	108,342	32503	65005	108342
4-3/4 x 8	7-1/4"	16.815	160,000	2,152,317	92,864	85,196	106,495	119,274	127,794	133,758	170,392	255,588	127,794	38338	76676	127794
5 x 8	7-5/8"	18.681	160,000	2,391,118	108,597	99,630	124,537	139,482	149,445	156,419	199,260	298,890	149,445	44833	89667	149445
5-1/4 x 8	8"	20.644	160,000	2,642,480	126,013	115,608	144,511	161,852	173,413	181,505	231,217	346,825	173,413	52024	104048	173413
5-1/2 x 8	8-3/8"	22.706	160,000	2,906,401	145,199	133,210	166,513	186,494	199,815	209,140	266,420	399,630	199,815	59945	119889	199815
5-3/4 x 8	8-3/4"	24.866	160,000	3,182,882	166,239	152,513	190,641	213,518	228,770	239,446	305,026	457,539	228,770	68631	137262	228770
6 x 8	9-1/8"	27.124	160,000	3,471,924	189,220	173,596	216,995	243,035	260,394	272,546	347,192	520,789	260,394	78118	156237	260394

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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HYTORC

TORQUE GUIDE FOR ISO **R898** GRADE **12.9** STUD

BOLT TENSION BASED ON 90 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.15	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	160,000	48,138	328	301	376	421	451	472	602	903	451	135	271	451
7/8 x 9	1-7/16"	0.461	160,000	66,456	528	485	606	678	727	761	969	1,454	727	218	436	727
1x 8	1-5/8"	0.605	160,000	87,183	792	727	908	1,017	1,090	1,141	1,453	2,180	1,090	327	654	1090
1-1/8 x 8	1-13/16"	0.790	160,000	113,767	1,163	1,067	1,333	1,493	1,600	1,675	2,133	3,200	1,600	480	960	1600
1-1/4 x 8	2"	0.999	160,000	143,884	1,634	1,499	1,873	2,098	2,248	2,353	2,998	4,496	2,248	674	1349	2248
1-3/8 x 8	2-3/16"	1.233	160,000	177,534	2,217	2,034	2,543	2,848	3,051	3,194	4,068	6,103	3,051	915	1831	3051
1-1/2 x 8	2-3/8"	1.491	160,000	214,716	2,926	2,684	3,355	3,758	4,026	4,214	5,368	8,052	4,026	1208	2416	4026
1-5/8 x 8	2-9/16"	1.774	160,000	255,431	3,770	3,459	4,324	4,843	5,188	5,431	6,918	10,377	5,188	1557	3113	5188
1-3/4 x 8	2-3/4"	2.081	160,000	299,678	4,764	4,370	5,463	6,118	6,555	6,861	8,741	13,111	6,555	1967	3933	6555
1-7/8 x 8	2-15/16"	2.413	160,000	347,457	5,918	5,429	6,786	7,601	8,144	8,524	10,858	16,287	8,144	2443	4886	8144
2 x 8	3-1/8"	2.769	160,000	398,769	7,244	6,646	8,308	9,305	9,969	10,434	13,292	19,938	9,969	2991	5982	9969
2-1/8 x 8	3-5/16"	3.150	160,000	453,614	8,756	8,033	10,041	11,246	12,049	12,611	16,065	24,098	12,049	3615	7229	12049
2-1/4 x 8	3-1/2"	3.555	160,000	511,991	10,464	9,600	12,000	13,440	14,400	15,072	19,200	28,799	14,400	4320	8640	14400
2-3/8 x 8	3-11/16"	3.985	160,000	573,900	12,381	11,358	14,198	15,902	17,038	17,833	22,717	34,075	17,038	5111	10223	17038
2-1/2 x 8	3-7/8"	4.440	160,000	639,342	14,518	13,320	16,650	18,647	19,979	20,912	26,639	39,959	19,979	5994	11988	19979
2-3/4 x 8	4-1/4"	5.422	160,000	780,824	19,504	17,894	22,367	25,051	26,841	28,093	35,788	53,682	26,841	8052	16104	26841
3 x 8	4-5/8"	6.503	160,000	936,435	25,518	23,411	29,264	32,775	35,116	36,755	46,822	70,233	35,116	10535	21070	35116
3-1/4 x 8	5"	7.682	160,000	1,106,177	32,655	29,959	37,449	41,943	44,938	47,036	59,918	89,877	44,938	13482	26963	44938
3-1/2 x 8	5-3/8"	8.959	160,000	1,290,049	41,013	37,626	47,033	52,677	56,440	59,073	75,253	112,879	56,440	16932	33864	56440
3-3/4 x 8	5-3/4"	10.334	160,000	1,488,050	50,687	46,502	58,127	65,102	69,752	73,007	93,003	139,505	69,752	20926	41851	69752
4 x 8	6-1/8"	11.807	160,000	1,700,182	61,773	56,673	70,841	79,342	85,009	88,976	113,345	170,018	85,009	25503	51005	85009
4-1/4 x 8	6-1/2"	13.378	160,000	1,926,443	74,369	68,228	85,285	95,519	102,342	107,118	136,456	204,685	102,342	30703	61405	102342
4-1/2 x 8	6-7/8"	15.047	160,000	2,166,835	88,569	81,256	101,570	113,759	121,884	127,572	162,513	243,769	121,884	36565	73131	121884
4-3/4 x 8	7-1/4"	16.815	160,000	2,421,356	104,471	95,845	119,807	134,184	143,768	150,477	191,691	287,536	143,768	43130	86261	143768
5 x 8	7-5/8"	18.681	160,000	2,690,008	122,171	112,084	140,105	156,917	168,126	175,971	224,167	336,251	168,126	50438	100875	168126
5-1/4 x 8	8"	20.644	160,000	2,972,790	141,765	130,060	162,574	182,083	195,089	204,193	260,119	390,179	195,089	58527	117054	195089
5-1/2 x 8	8-3/8"	22.706	160,000	3,269,701	163,349	149,861	187,327	209,806	224,792	235,282	299,723	449,584	224,792	67438	134875	224792
5-3/4 x 8	8-3/4"	24.866	160,000	3,580,743	187,019	171,577	214,472	240,208	257,366	269,376	343,155	514,732	257,366	77210	154420	257366
6 x 8	9-1/8"	27.124	160,000	3,905,914	212,872	195,296	244,120	273,414	292,944	306,614	390,591	585,887	292,944	87883	175766	292944

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TORQUE GUIDE FOR ISO **R898** GRADE **12.9** STUD

BOLT TENSION BASED ON 99 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.15	MACHINE OIL K=.200	DRY STEEL K=.440 K=.300	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	160,000	52,952	361	331	414	463	496	520	662	993	496	149	298	496
7/8 x 9	1-7/16"	0.461	160,000	73,101	581	533	666	746	800	837	1,066	1,599	800	240	480	800
1x 8	1-5/8"	0.605	160,000	95,901	871	799	999	1,119	1,199	1,255	1,598	2,398	1,199	360	719	1199
1-1/8 x 8	1-13/16"	0.790	160,000	125,144	1,279	1,173	1,467	1,643	1,760	1,842	2,346	3,520	1,760	528	1056	1760
1-1/4 x 8	2"	0.999	160,000	158,273	1,797	1,649	2,061	2,308	2,473	2,588	3,297	4,946	2,473	742	1484	2473
1-3/8 x 8	2-3/16"	1.233	160,000	195,287	2,439	2,238	2,797	3,133	3,357	3,513	4,475	6,713	3,357	1007	2014	3357
1-1/2 x 8	2-3/8"	1.491	160,000	236,188	3,218	2,952	3,690	4,133	4,429	4,635	5,905	8,857	4,429	1329	2657	4429
1-5/8 x 8	2-9/16"	1.774	160,000	280,974	4,147	3,805	4,756	5,327	5,707	5,974	7,610	11,415	5,707	1712	3424	5707
1-3/4 x 8	2-3/4"	2.081	160,000	329,645	5,240	4,807	6,009	6,730	7,211	7,548	9,615	14,422	7,211	2163	4327	7211
1-7/8 x 8	2-15/16"	2.413	160,000	382,203	6,509	5,972	7,465	8,361	8,958	9,376	11,944	17,916	8,958	2687	5375	8958
2 x 8	3-1/8"	2.769	160,000	438,646	7,969	7,311	9,138	10,235	10,966	11,478	14,622	21,932	10,966	3290	6580	10966
2-1/8 x 8	3-5/16"	3.150	160,000	498,975	9,631	8,836	11,045	12,370	13,254	13,873	17,672	26,508	13,254	3976	7952	13254
2-1/4 x 8	3-1/2"	3.555	160,000	563,190	11,510	10,560	13,200	14,784	15,840	16,579	21,120	31,679	15,840	4752	9504	15840
2-3/8 x 8	3-11/16"	3.985	160,000	631,290	13,619	12,494	15,618	17,492	18,741	19,616	24,989	37,483	18,741	5622	11245	18741
2-1/2 x 8	3-7/8"	4.440	160,000	703,277	15,970	14,652	18,314	20,512	21,977	23,003	29,303	43,955	21,977	6593	13186	21977
2-3/4 x 8	4-1/4"	5.422	160,000	858,906	21,455	19,683	24,604	27,557	29,525	30,903	39,367	59,050	29,525	8857	17715	29525
3 x 8	4-5/8"	6.503	160,000	1,030,079	28,070	25,752	32,190	36,053	38,628	40,431	51,504	77,256	38,628	11588	23177	38628
3-1/4 x 8	5"	7.682	160,000	1,216,795	35,921	32,955	41,194	46,137	49,432	51,739	65,910	98,865	49,432	14830	29659	49432
3-1/2 x 8	5-3/8"	8.959	160,000	1,419,053	45,114	41,389	51,736	57,945	62,084	64,981	82,778	124,167	62,084	18625	37250	62084
3-3/4 x 8	5-3/4"	10.334	160,000	1,636,855	55,755	51,152	63,940	71,612	76,728	80,308	102,303	153,455	76,728	23018	46037	76728
4 x 8	6-1/8"	11.807	160,000	1,870,200	67,951	62,340	77,925	87,276	93,510	97,874	124,680	187,020	93,510	28053	56106	93510
4-1/4 x 8	6-1/2"	13.378	160,000	2,119,088	81,806	75,051	93,814	105,071	112,577	117,830	150,102	225,153	112,577	33773	67546	112577
4-1/2 x 8	6-7/8"	15.047	160,000	2,383,518	97,426	89,382	111,727	125,135	134,073	140,330	178,764	268,146	134,073	40222	80444	134073
4-3/4 x 8	7-1/4"	16.815	160,000	2,663,492	114,919	105,430	131,787	147,602	158,145	165,525	210,860	316,290	158,145	47443	94887	158145
5 x 8	7-5/8"	18.681	160,000	2,959,009	134,388	123,292	154,115	172,609	184,938	193,568	246,584	369,876	184,938	55481	110963	184938
5-1/4 x 8	8"	20.644	160,000	3,270,069	155,941	143,066	178,832	200,292	214,598	224,613	286,131	429,197	214,598	64379	128759	214598
5-1/2 x 8	8-3/8"	22.706	160,000	3,596,671	179,684	164,847	206,059	230,786	247,271	258,810	329,695	494,542	247,271	74181	148363	247271
5-3/4 x 8	8-3/4"	24.866	160,000	3,938,817	205,721	188,735	235,919	264,229	283,102	296,314	377,470	566,205	283,102	84931	169861	283102
6 x 8	9-1/8"	27.124	160,000	4,296,506	234,160	214,825	268,532	300,755	322,238	337,276	429,651	644,476	322,238	96671	193343	322238

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
If 'K' factor is not listed, Enter appropriate value under Custom (insert K) , in yellow field only
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TORQUE GUIDE FOR ASTM **A320** GRADE **L7** BOLT TENSION BASED ON 40 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	105,000	14,040	96	88	110	123	132	138	176	263	132	39	79	132
7/8 x 9	1-7/16"	0.461	105,000	19,383	154	141	177	198	212	222	283	424	212	64	127	212
1x 8	1-5/8"	0.605	105,000	25,428	231	212	265	297	318	333	424	636	318	95	191	318
1-1/8 x 8	1-13/16"	0.790	105,000	33,182	339	311	389	436	467	488	622	933	467	140	280	467
1-1/4 x 8	2"	0.999	105,000	41,966	476	437	546	612	656	686	874	1,311	656	197	393	656
1-3/8 x 8	2-3/16"	1.233	105,000	51,781	647	593	742	831	890	932	1,187	1,780	890	267	534	890
1-1/2 x 8	2-3/8"	1.491	105,000	62,626	853	783	979	1,096	1,174	1,229	1,566	2,348	1,174	352	705	1174
1-5/8 x 8	2-9/16"	1.774	105,000	74,501	1,100	1,009	1,261	1,412	1,513	1,584	2,018	3,027	1,513	454	908	1513
1-3/4 x 8	2-3/4"	2.081	105,000	87,406	1,389	1,275	1,593	1,785	1,912	2,001	2,549	3,824	1,912	574	1147	1912
1-7/8 x 8	2-15/16"	2.413	105,000	101,342	1,726	1,583	1,979	2,217	2,375	2,486	3,167	4,750	2,375	713	1425	2375
2 x 8	3-1/8"	2.769	105,000	116,308	2,113	1,938	2,423	2,714	2,908	3,043	3,877	5,815	2,908	872	1745	2908
2-1/8 x 8	3-5/16"	3.150	105,000	132,304	2,554	2,343	2,929	3,280	3,514	3,678	4,686	7,029	3,514	1054	2109	3514
2-1/4 x 8	3-1/2"	3.555	105,000	149,331	3,052	2,800	3,500	3,920	4,200	4,396	5,600	8,400	4,200	1260	2520	4200
2-3/8 x 8	3-11/16"	3.985	105,000	167,388	3,611	3,313	4,141	4,638	4,969	5,201	6,626	9,939	4,969	1491	2982	4969
2-1/2 x 8	3-7/8"	4.440	105,000	186,475	4,235	3,885	4,856	5,439	5,827	6,099	7,770	11,655	5,827	1748	3496	5827

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Enter the desired percent yield in yellow field at top of form
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HYTORC

TORQUE GUIDE FOR ASTM **A320** GRADE **L7**

BOLT TENSION BASED ON 50 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN²)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	105,000	17,550	120	110	137	154	165	172	219	329	165	49	99	165
7/8 x 9	1-7/16"	0.461	105,000	24,229	193	177	221	247	265	277	353	530	265	80	159	265
1x 8	1-5/8"	0.605	105,000	31,785	289	265	331	371	397	416	530	795	397	119	238	397
1-1/8 x 8	1-13/16"	0.790	105,000	41,478	424	389	486	544	583	611	778	1,167	583	175	350	583
1-1/4 x 8	2"	0.999	105,000	52,458	596	546	683	765	820	858	1,093	1,639	820	246	492	820
1-3/8 x 8	2-3/16"	1.233	105,000	64,726	808	742	927	1,038	1,112	1,164	1,483	2,225	1,112	334	667	1112
1-1/2 x 8	2-3/8"	1.491	105,000	78,282	1,067	979	1,223	1,370	1,468	1,536	1,957	2,936	1,468	440	881	1468
1-5/8 x 8	2-9/16"	1.774	105,000	93,126	1,375	1,261	1,576	1,766	1,892	1,980	2,522	3,783	1,892	567	1135	1892
1-3/4 x 8	2-3/4"	2.081	105,000	109,257	1,737	1,593	1,992	2,231	2,390	2,502	3,187	4,780	2,390	717	1434	2390
1-7/8 x 8	2-15/16"	2.413	105,000	126,677	2,157	1,979	2,474	2,771	2,969	3,108	3,959	5,938	2,969	891	1781	2969
2 x 8	3-1/8"	2.769	105,000	145,385	2,641	2,423	3,029	3,392	3,635	3,804	4,846	7,269	3,635	1090	2181	3635
2-1/8 x 8	3-5/16"	3.150	105,000	165,380	3,192	2,929	3,661	4,100	4,393	4,598	5,857	8,786	4,393	1318	2636	4393
2-1/4 x 8	3-1/2"	3.555	105,000	186,663	3,815	3,500	4,375	4,900	5,250	5,495	7,000	10,500	5,250	1575	3150	5250
2-3/8 x 8	3-11/16"	3.985	105,000	209,234	4,514	4,141	5,176	5,798	6,212	6,502	8,282	12,423	6,212	1863	3727	6212
2-1/2 x 8	3-7/8"	4.440	105,000	233,094	5,293	4,856	6,070	6,799	7,284	7,624	9,712	14,568	7,284	2185	4371	7284

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Enter the desired percent yield in yellow field at top of form
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TORQUE GUIDE FOR ASTM **A320** GRADE **L7**

BOLT TENSION BASED ON 60 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	105,000	21,060	143	132	165	184	197	207	263	395	197	59	118	197
7/8 x 9	1-7/16"	0.461	105,000	29,074	231	212	265	297	318	333	424	636	318	95	191	318
1x 8	1-5/8"	0.605	105,000	38,143	346	318	397	445	477	499	636	954	477	143	286	477
1-1/8 x 8	1-13/16"	0.790	105,000	49,773	509	467	583	653	700	733	933	1,400	700	210	420	700
1-1/4 x 8	2"	0.999	105,000	62,949	715	656	820	918	984	1,029	1,311	1,967	984	295	590	984
1-3/8 x 8	2-3/16"	1.233	105,000	77,671	970	890	1,112	1,246	1,335	1,397	1,780	2,670	1,335	400	801	1335
1-1/2 x 8	2-3/8"	1.491	105,000	93,938	1,280	1,174	1,468	1,644	1,761	1,844	2,348	3,523	1,761	528	1057	1761
1-5/8 x 8	2-9/16"	1.774	105,000	111,751	1,649	1,513	1,892	2,119	2,270	2,376	3,027	4,540	2,270	681	1362	2270
1-3/4 x 8	2-3/4"	2.081	105,000	131,109	2,084	1,912	2,390	2,677	2,868	3,002	3,824	5,736	2,868	860	1721	2868
1-7/8 x 8	2-15/16"	2.413	105,000	152,013	2,589	2,375	2,969	3,325	3,563	3,729	4,750	7,126	3,563	1069	2138	3563
2 x 8	3-1/8"	2.769	105,000	174,462	3,169	2,908	3,635	4,071	4,362	4,565	5,815	8,723	4,362	1308	2617	4362
2-1/8 x 8	3-5/16"	3.150	105,000	198,456	3,831	3,514	4,393	4,920	5,271	5,517	7,029	10,543	5,271	1581	3163	5271
2-1/4 x 8	3-1/2"	3.555	105,000	223,996	4,578	4,200	5,250	5,880	6,300	6,594	8,400	12,600	6,300	1890	3780	6300
2-3/8 x 8	3-11/16"	3.985	105,000	251,081	5,417	4,969	6,212	6,957	7,454	7,802	9,939	14,908	7,454	2236	4472	7454
2-1/2 x 8	3-7/8"	4.440	105,000	279,712	6,352	5,827	7,284	8,158	8,741	9,149	11,655	17,482	8,741	2622	5245	8741

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TORQUE GUIDE FOR ASTM **A320** GRADE **L7**

BOLT TENSION BASED ON 70 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	105,000	24,570	167	154	192	215	230	241	307	461	230	69	138	230
7/8 x 9	1-7/16"	0.461	105,000	33,920	270	247	309	346	371	388	495	742	371	111	223	371
1x 8	1-5/8"	0.605	105,000	44,500	404	371	464	519	556	582	742	1,112	556	167	334	556
1-1/8 x 8	1-13/16"	0.790	105,000	58,069	593	544	680	762	817	855	1,089	1,633	817	245	490	817
1-1/4 x 8	2"	0.999	105,000	73,441	834	765	956	1,071	1,148	1,201	1,530	2,295	1,148	344	689	1148
1-3/8 x 8	2-3/16"	1.233	105,000	90,616	1,132	1,038	1,298	1,454	1,557	1,630	2,077	3,115	1,557	467	934	1557
1-1/2 x 8	2-3/8"	1.491	105,000	109,595	1,493	1,370	1,712	1,918	2,055	2,151	2,740	4,110	2,055	616	1233	2055
1-5/8 x 8	2-9/16"	1.774	105,000	130,376	1,924	1,766	2,207	2,472	2,648	2,772	3,531	5,297	2,648	794	1589	2648
1-3/4 x 8	2-3/4"	2.081	105,000	152,960	2,431	2,231	2,788	3,123	3,346	3,502	4,461	6,692	3,346	1004	2008	3346
1-7/8 x 8	2-15/16"	2.413	105,000	177,348	3,020	2,771	3,464	3,879	4,157	4,351	5,542	8,313	4,157	1247	2494	4157
2 x 8	3-1/8"	2.769	105,000	203,538	3,698	3,392	4,240	4,749	5,088	5,326	6,785	10,177	5,088	1527	3053	5088
2-1/8 x 8	3-5/16"	3.150	105,000	231,532	4,469	4,100	5,125	5,740	6,150	6,437	8,200	12,300	6,150	1845	3690	6150
2-1/4 x 8	3-1/2"	3.555	105,000	261,329	5,341	4,900	6,125	6,860	7,350	7,693	9,800	14,700	7,350	2205	4410	7350
2-3/8 x 8	3-11/16"	3.985	105,000	292,928	6,319	5,798	7,247	8,117	8,696	9,102	11,595	17,393	8,696	2609	5218	8696
2-1/2 x 8	3-7/8"	4.440	105,000	326,331	7,410	6,799	8,498	9,518	10,198	10,674	13,597	20,396	10,198	3059	6119	10198

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TORQUE GUIDE FOR ASTM **A320** GRADE **L7** BOLT TENSION BASED ON 80 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	105,000	28,080	191	176	219	246	263	276	351	527	263	79	158	263
7/8 x 9	1-7/16"	0.461	105,000	38,766	308	283	353	396	424	444	565	848	424	127	254	424
1x 8	1-5/8"	0.605	105,000	50,857	462	424	530	593	636	665	848	1,271	636	191	381	636
1-1/8 x 8	1-13/16"	0.790	105,000	66,364	678	622	778	871	933	977	1,244	1,866	933	280	560	933
1-1/4 x 8	2"	0.999	105,000	83,933	953	874	1,093	1,224	1,311	1,373	1,749	2,623	1,311	393	787	1311
1-3/8 x 8	2-3/16"	1.233	105,000	103,562	1,293	1,187	1,483	1,661	1,780	1,863	2,373	3,560	1,780	534	1068	1780
1-1/2 x 8	2-3/8"	1.491	105,000	125,251	1,707	1,566	1,957	2,192	2,348	2,458	3,131	4,697	2,348	705	1409	2348
1-5/8 x 8	2-9/16"	1.774	105,000	149,001	2,199	2,018	2,522	2,825	3,027	3,168	4,035	6,053	3,027	908	1816	3027
1-3/4 x 8	2-3/4"	2.081	105,000	174,812	2,779	2,549	3,187	3,569	3,824	4,002	5,099	7,648	3,824	1147	2294	3824
1-7/8 x 8	2-15/16"	2.413	105,000	202,683	3,452	3,167	3,959	4,434	4,750	4,972	6,334	9,501	4,750	1425	2850	4750
2 x 8	3-1/8"	2.769	105,000	232,615	4,226	3,877	4,846	5,428	5,815	6,087	7,754	11,631	5,815	1745	3489	5815
2-1/8 x 8	3-5/16"	3.150	105,000	264,608	5,107	4,686	5,857	6,560	7,029	7,357	9,372	14,057	7,029	2109	4217	7029
2-1/4 x 8	3-1/2"	3.555	105,000	298,661	6,104	5,600	7,000	7,840	8,400	8,792	11,200	16,800	8,400	2520	5040	8400
2-3/8 x 8	3-11/16"	3.985	105,000	334,775	7,222	6,626	8,282	9,276	9,939	10,402	13,252	19,877	9,939	2982	5963	9939
2-1/2 x 8	3-7/8"	4.440	105,000	372,950	8,469	7,770	9,712	10,878	11,655	12,199	15,540	23,309	11,655	3496	6993	11655

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TORQUE GUIDE FOR ASTM **A320** GRADE **L7** BOLT TENSION BASED ON 90 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	105,000	31,590	215	197	247	276	296	310	395	592	296	89	178	296
7/8 x 9	1-7/16"	0.461	105,000	43,612	347	318	398	445	477	499	636	954	477	143	286	477
1x 8	1-5/8"	0.605	105,000	57,214	520	477	596	667	715	749	954	1,430	715	215	429	715
1-1/8 x 8	1-13/16"	0.790	105,000	74,660	763	700	875	980	1,050	1,099	1,400	2,100	1,050	315	630	1050
1-1/4 x 8	2"	0.999	105,000	94,424	1,072	984	1,229	1,377	1,475	1,544	1,967	2,951	1,475	443	885	1475
1-3/8 x 8	2-3/16"	1.233	105,000	116,507	1,455	1,335	1,669	1,869	2,002	2,096	2,670	4,005	2,002	601	1201	2002
1-1/2 x 8	2-3/8"	1.491	105,000	140,907	1,920	1,761	2,202	2,466	2,642	2,765	3,523	5,284	2,642	793	1585	2642
1-5/8 x 8	2-9/16"	1.774	105,000	167,626	2,474	2,270	2,837	3,178	3,405	3,564	4,540	6,810	3,405	1021	2043	3405
1-3/4 x 8	2-3/4"	2.081	105,000	196,663	3,126	2,868	3,585	4,015	4,302	4,503	5,736	8,604	4,302	1291	2581	4302
1-7/8 x 8	2-15/16"	2.413	105,000	228,019	3,883	3,563	4,453	4,988	5,344	5,594	7,126	10,688	5,344	1603	3207	5344
2 x 8	3-1/8"	2.769	105,000	261,692	4,754	4,362	5,452	6,106	6,542	6,848	8,723	13,085	6,542	1963	3925	6542
2-1/8 x 8	3-5/16"	3.150	105,000	297,684	5,746	5,271	6,589	7,380	7,907	8,276	10,543	15,814	7,907	2372	4744	7907
2-1/4 x 8	3-1/2"	3.555	105,000	335,994	6,867	6,300	7,875	8,820	9,450	9,891	12,600	18,900	9,450	2835	5670	9450
2-3/8 x 8	3-11/16"	3.985	105,000	376,622	8,125	7,454	9,317	10,436	11,181	11,703	14,908	22,362	11,181	3354	6709	11181
2-1/2 x 8	3-7/8"	4.440	105,000	419,568	9,528	8,741	10,926	12,237	13,112	13,723	17,482	26,223	13,112	3933	7867	13112

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TORQUE GUIDE FOR ASTM **A320** GRADE **L7** BOLT TENSION BASED ON 99 % YIELD					REQUIRED TORQUE (FtLbs)									THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL& GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 **0.15**	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	105,000	34,749	237	217	271	304	326	341	434	652	326	98	195	326
7/8 x 9	1-7/16"	0.461	105,000	47,973	381	350	437	490	525	549	700	1,049	525	157	315	525
1x 8	1-5/8"	0.605	105,000	62,935	572	524	656	734	787	823	1,049	1,573	787	236	472	787
1-1/8 x 8	1-13/16"	0.790	105,000	82,126	839	770	962	1,078	1,155	1,209	1,540	2,310	1,155	346	693	1155
1-1/4 x 8	2"	0.999	105,000	103,867	1,179	1,082	1,352	1,515	1,623	1,699	2,164	3,246	1,623	487	974	1623
1-3/8 x 8	2-3/16"	1.233	105,000	128,157	1,601	1,468	1,836	2,056	2,203	2,305	2,937	4,405	2,203	661	1322	2203
1-1/2 x 8	2-3/8"	1.491	105,000	154,998	2,112	1,937	2,422	2,712	2,906	3,042	3,875	5,812	2,906	872	1744	2906
1-5/8 x 8	2-9/16"	1.774	105,000	184,389	2,722	2,497	3,121	3,496	3,745	3,920	4,994	7,491	3,745	1124	2247	3745
1-3/4 x 8	2-3/4"	2.081	105,000	216,330	3,439	3,155	3,944	4,417	4,732	4,953	6,310	9,464	4,732	1420	2839	4732
1-7/8 x 8	2-15/16"	2.413	105,000	250,821	4,272	3,919	4,899	5,487	5,879	6,153	7,838	11,757	5,879	1764	3527	5879
2 x 8	3-1/8"	2.769	105,000	287,862	5,229	4,798	5,997	6,717	7,197	7,532	9,595	14,393	7,197	2159	4318	7197
2-1/8 x 8	3-5/16"	3.150	105,000	327,452	6,321	5,799	7,248	8,118	8,698	9,104	11,597	17,396	8,698	2609	5219	8698
2-1/4 x 8	3-1/2"	3.555	105,000	369,593	7,554	6,930	8,662	9,702	10,395	10,880	13,860	20,790	10,395	3118	6237	10395
2-3/8 x 8	3-11/16"	3.985	105,000	414,284	8,937	8,199	10,249	11,479	12,299	12,873	16,399	24,598	12,299	3690	7379	12299
2-1/2 x 8	3-7/8"	4.440	105,000	461,525	10,480	9,615	12,019	13,461	14,423	15,096	19,230	28,845	14,423	4327	8654	14423

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TORQUE GUIDE FOR ASTM **A320** CLASS **L7** GRADE **M** BOLT TENSION BASED ON 40 % YIELD					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 0.15	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	80,000	10,697	73	67	84	94	100	105	134	201	100	30	60	100
7/8 x 9	1-7/16"	0.461	80,000	14,768	117	108	135	151	162	169	215	323	162	48	97	162
1x 8	1-5/8"	0.605	80,000	19,374	176	161	202	226	242	253	323	484	242	73	145	242
1-1/8 x 8	1-13/16"	0.790	80,000	25,282	258	237	296	332	356	372	474	711	356	107	213	356
1-1/4 x 8	2"	0.999	80,000	31,974	363	333	416	466	500	523	666	999	500	150	300	500
1-3/8 x 8	2-3/16"	1.233	80,000	39,452	493	452	565	633	678	710	904	1,356	678	203	407	678
1-1/2 x 8	2-3/8"	1.491	80,000	47,715	650	596	746	835	895	936	1,193	1,789	895	268	537	895
1-5/8 x 8	2-9/16"	1.774	80,000	56,762	838	769	961	1,076	1,153	1,207	1,537	2,306	1,153	346	692	1153
1-3/4 x 8	2-3/4"	2.081	80,000	66,595	1,059	971	1,214	1,360	1,457	1,525	1,942	2,914	1,457	437	874	1457
1-7/8 x 8	2-15/16"	2.413	80,000	77,213	1,315	1,206	1,508	1,689	1,810	1,894	2,413	3,619	1,810	543	1086	1810
2 x 8	3-1/8"	2.769	80,000	88,615	1,610	1,477	1,846	2,068	2,215	2,319	2,954	4,431	2,215	665	1329	2215
2-1/8 x 8	3-5/16"	3.150	80,000	100,803	1,946	1,785	2,231	2,499	2,678	2,803	3,570	5,355	2,678	803	1607	2678
2-1/4 x 8	3-1/2"	3.555	80,000	113,776	2,325	2,133	2,667	2,987	3,200	3,349	4,267	6,400	3,200	960	1920	3200
2-3/8 x 8	3-11/16"	3.985	80,000	127,533	2,751	2,524	3,155	3,534	3,786	3,963	5,048	7,572	3,786	1136	2272	3786
2-1/2 x 8	3-7/8"	4.440	80,000	142,076	3,226	2,960	3,700	4,144	4,440	4,647	5,920	8,880	4,440	1332	2664	4440
2-3/4 x 8	4-1/4"	5.422	80,000	173,516	4,334	3,976	4,971	5,567	5,965	6,243	7,953	11,929	5,965	1789	3579	5965
3 x 8	4-5/8"	6.503	80,000	208,097	5,671	5,202	6,503	7,283	7,804	8,168	10,405	15,607	7,804	2341	4682	7804
3-1/4 x 8	5"	7.682	80,000	245,817	7,257	6,658	8,322	9,321	9,986	10,452	13,315	19,973	9,986	2996	5992	9986
3-1/2 x 8	5-3/8"	8.959	80,000	286,677	9,114	8,361	10,452	11,706	12,542	13,127	16,723	25,084	12,542	3763	7525	12542

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TORQUE GUIDE FOR ASTM **A320** CLASS **L7** GRADE **M**					**REQUIRED TORQUE** (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT TENSION BASED ON			50	% YIELD												
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN²)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300	First Pass	Second Pass	All Subsequent Passes
													0.15	**30%**	**60%**	**100%**
3/4 x 10	1-1/4"	0.334	80,000	13,372	91	84	104	117	125	131	167	251	125	38	75	125
7/8 x 9	1-7/16"	0.461	80,000	18,460	147	135	168	188	202	211	269	404	202	61	121	202
1x 8	1-5/8"	0.605	80,000	24,217	220	202	252	283	303	317	404	605	303	91	182	303
1-1/8 x 8	1-13/16"	0.790	80,000	31,602	323	296	370	415	444	465	593	889	444	133	267	444
1-1/4 x 8	2"	0.999	80,000	39,968	454	416	520	583	624	654	833	1,249	624	187	375	624
1-3/8 x 8	2-3/16"	1.233	80,000	49,315	616	565	706	791	848	887	1,130	1,695	848	254	509	848
1-1/2 x 8	2-3/8"	1.491	80,000	59,643	813	746	932	1,044	1,118	1,171	1,491	2,237	1,118	335	671	1118
1-5/8 x 8	2-9/16"	1.774	80,000	70,953	1,047	961	1,201	1,345	1,441	1,508	1,922	2,882	1,441	432	865	1441
1-3/4 x 8	2-3/4"	2.081	80,000	83,244	1,323	1,214	1,517	1,700	1,821	1,906	2,428	3,642	1,821	546	1093	1821
1-7/8 x 8	2-15/16"	2.413	80,000	96,516	1,644	1,508	1,885	2,111	2,262	2,368	3,016	4,524	2,262	679	1357	2262
2 x 8	3-1/8"	2.769	80,000	110,769	2,012	1,846	2,308	2,585	2,769	2,898	3,692	5,538	2,769	831	1662	2769
2-1/8 x 8	3-5/16"	3.150	80,000	126,004	2,432	2,231	2,789	3,124	3,347	3,503	4,463	6,694	3,347	1004	2008	3347
2-1/4 x 8	3-1/2"	3.555	80,000	142,220	2,907	2,667	3,333	3,733	4,000	4,187	5,333	8,000	4,000	1200	2400	4000
2-3/8 x 8	3-11/16"	3.985	80,000	159,417	3,439	3,155	3,944	4,417	4,733	4,954	6,310	9,465	4,733	1420	2840	4733
2-1/2 x 8	3-7/8"	4.440	80,000	177,595	4,033	3,700	4,625	5,180	5,550	5,809	7,400	11,100	5,550	1665	3330	5550
2-3/4 x 8	4-1/4"	5.422	80,000	216,896	5,418	4,971	6,213	6,959	7,456	7,804	9,941	14,912	7,456	2237	4473	7456
3 x 8	4-5/8"	6.503	80,000	260,121	7,088	6,503	8,129	9,104	9,755	10,210	13,006	19,509	9,755	2926	5853	9755
3-1/4 x 8	5"	7.682	80,000	307,271	9,071	8,322	10,402	11,651	12,483	13,065	16,644	24,966	12,483	3745	7490	12483
3-1/2 x 8	5-3/8"	8.959	80,000	358,347	11,392	10,452	13,065	14,632	15,678	16,409	20,904	31,355	15,678	4703	9407	15678

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TORQUE GUIDE FOR ASTM **A320** CLASS **L7** GRADE **M**

BOLT TENSION BASED ON 60 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 0.15	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	80,000	16,046	109	100	125	140	150	157	201	301	150	45	90	150
7/8 x 9	1-7/16"	0.461	80,000	22,152	176	162	202	226	242	254	323	485	242	73	145	242
1x 8	1-5/8"	0.605	80,000	29,061	264	242	303	339	363	380	484	727	363	109	218	363
1-1/8 x 8	1-13/16"	0.790	80,000	37,922	388	356	444	498	533	558	711	1,067	533	160	320	533
1-1/4 x 8	2"	0.999	80,000	47,961	545	500	624	699	749	784	999	1,499	749	225	450	749
1-3/8 x 8	2-3/16"	1.233	80,000	59,178	739	678	848	949	1,017	1,065	1,356	2,034	1,017	305	610	1017
1-1/2 x 8	2-3/8"	1.491	80,000	71,572	975	895	1,118	1,253	1,342	1,405	1,789	2,684	1,342	403	805	1342
1-5/8 x 8	2-9/16"	1.774	80,000	85,144	1,257	1,153	1,441	1,614	1,729	1,810	2,306	3,459	1,729	519	1038	1729
1-3/4 x 8	2-3/4"	2.081	80,000	99,893	1,588	1,457	1,821	2,039	2,185	2,287	2,914	4,370	2,185	656	1311	2185
1-7/8 x 8	2-15/16"	2.413	80,000	115,819	1,973	1,810	2,262	2,534	2,715	2,841	3,619	5,429	2,715	814	1629	2715
2 x 8	3-1/8"	2.769	80,000	132,923	2,415	2,215	2,769	3,102	3,323	3,478	4,431	6,646	3,323	997	1994	3323
2-1/8 x 8	3-5/16"	3.150	80,000	151,205	2,919	2,678	3,347	3,749	4,016	4,204	5,355	8,033	4,016	1205	2410	4016
2-1/4 x 8	3-1/2"	3.555	80,000	170,664	3,488	3,200	4,000	4,480	4,800	5,024	6,400	9,600	4,800	1440	2880	4800
2-3/8 x 8	3-11/16"	3.985	80,000	191,300	4,127	3,786	4,733	5,301	5,679	5,944	7,572	11,358	5,679	1704	3408	5679
2-1/2 x 8	3-7/8"	4.440	80,000	213,114	4,839	4,440	5,550	6,216	6,660	6,971	8,880	13,320	6,660	1998	3996	6660
2-3/4 x 8	4-1/4"	5.422	80,000	260,275	6,501	5,965	7,456	8,350	8,947	9,364	11,929	17,894	8,947	2684	5368	8947
3 x 8	4-5/8"	6.503	80,000	312,145	8,506	7,804	9,755	10,925	11,705	12,252	15,607	23,411	11,705	3512	7023	11705
3-1/4 x 8	5"	7.682	80,000	368,726	10,885	9,986	12,483	13,981	14,979	15,679	19,973	29,959	14,979	4494	8988	14979
3-1/2 x 8	5-3/8"	8.959	80,000	430,016	13,671	12,542	15,678	17,559	18,813	19,691	25,084	37,626	18,813	5644	11288	18813

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361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

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To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
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TORQUE GUIDE FOR ASTM **A320** CLASS **L7** GRADE **M** — BOLT TENSION BASED ON 70 % YIELD					REQUIRED TORQUE (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300	First Pass	Second Pass	All Subsequent Passes
													0.15	**30%**	**60%**	**100%**
3/4 x 10	1-1/4"	0.334	80,000	18,720	128	117	146	164	176	184	234	351	176	53	105	176
7/8 x 9	1-7/16"	0.461	80,000	25,844	205	188	236	264	283	296	377	565	283	85	170	283
1x 8	1-5/8"	0.605	80,000	33,904	308	283	353	396	424	444	565	848	424	127	254	424
1-1/8 x 8	1-13/16"	0.790	80,000	44,243	452	415	518	581	622	651	830	1,244	622	187	373	622
1-1/4 x 8	2"	0.999	80,000	55,955	635	583	729	816	874	915	1,166	1,749	874	262	525	874
1-3/8 x 8	2-3/16"	1.233	80,000	69,041	862	791	989	1,108	1,187	1,242	1,582	2,373	1,187	356	712	1187
1-1/2 x 8	2-3/8"	1.491	80,000	83,501	1,138	1,044	1,305	1,461	1,566	1,639	2,088	3,131	1,566	470	939	1566
1-5/8 x 8	2-9/16"	1.774	80,000	99,334	1,466	1,345	1,681	1,883	2,018	2,112	2,690	4,035	2,018	605	1211	2018
1-3/4 x 8	2-3/4"	2.081	80,000	116,541	1,853	1,700	2,124	2,379	2,549	2,668	3,399	5,099	2,549	765	1530	2549
1-7/8 x 8	2-15/16"	2.413	80,000	135,122	2,301	2,111	2,639	2,956	3,167	3,315	4,223	6,334	3,167	950	1900	3167
2 x 8	3-1/8"	2.769	80,000	155,077	2,817	2,585	3,231	3,618	3,877	4,058	5,169	7,754	3,877	1163	2326	3877
2-1/8 x 8	3-5/16"	3.150	80,000	176,405	3,405	3,124	3,905	4,373	4,686	4,904	6,248	9,372	4,686	1406	2811	4686
2-1/4 x 8	3-1/2"	3.555	80,000	199,108	4,069	3,733	4,667	5,227	5,600	5,861	7,467	11,200	5,600	1680	3360	5600
2-3/8 x 8	3-11/16"	3.985	80,000	223,183	4,815	4,417	5,521	6,184	6,626	6,935	8,834	13,252	6,626	1988	3975	6626
2-1/2 x 8	3-7/8"	4.440	80,000	248,633	5,646	5,180	6,475	7,252	7,770	8,132	10,360	15,540	7,770	2331	4662	7770
2-3/4 x 8	4-1/4"	5.422	80,000	303,654	7,585	6,959	8,698	9,742	10,438	10,925	13,917	20,876	10,438	3131	6263	10438
3 x 8	4-5/8"	6.503	80,000	364,169	9,924	9,104	11,380	12,746	13,656	14,294	18,208	27,313	13,656	4097	8194	13656
3-1/4 x 8	5"	7.682	80,000	430,180	12,699	11,651	14,563	16,311	17,476	18,292	23,301	34,952	17,476	5243	10486	17476
3-1/2 x 8	5-3/8"	8.959	80,000	501,686	15,949	14,632	18,291	20,485	21,949	22,973	29,265	43,897	21,949	6585	13169	21949

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TORQUE GUIDE FOR ASTM **A320** CLASS **L7** GRADE **M**

BOLT TENSION BASED ON 80 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 0.15	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	80,000	21,395	146	134	167	187	201	210	267	401	201	60	120	201
7/8 x 9	1-7/16"	0.461	80,000	29,536	235	215	269	302	323	338	431	646	323	97	194	323
1x 8	1-5/8"	0.605	80,000	38,748	352	323	404	452	484	507	646	969	484	145	291	484
1-1/8 x 8	1-13/16"	0.790	80,000	50,563	517	474	593	664	711	744	948	1,422	711	213	427	711
1-1/4 x 8	2"	0.999	80,000	63,949	726	666	833	933	999	1,046	1,332	1,998	999	300	600	999
1-3/8 x 8	2-3/16"	1.233	80,000	78,904	985	904	1,130	1,266	1,356	1,419	1,808	2,712	1,356	407	814	1356
1-1/2 x 8	2-3/8"	1.491	80,000	95,429	1,300	1,193	1,491	1,670	1,789	1,873	2,386	3,579	1,789	537	1074	1789
1-5/8 x 8	2-9/16"	1.774	80,000	113,525	1,676	1,537	1,922	2,152	2,306	2,414	3,075	4,612	2,306	692	1384	2306
1-3/4 x 8	2-3/4"	2.081	80,000	133,190	2,117	1,942	2,428	2,719	2,914	3,049	3,885	5,827	2,914	874	1748	2914
1-7/8 x 8	2-15/16"	2.413	80,000	154,425	2,630	2,413	3,016	3,378	3,619	3,788	4,826	7,239	3,619	1086	2172	3619
2 x 8	3-1/8"	2.769	80,000	177,231	3,220	2,954	3,692	4,135	4,431	4,638	5,908	8,862	4,431	1329	2658	4431
2-1/8 x 8	3-5/16"	3.150	80,000	201,606	3,891	3,570	4,463	4,998	5,355	5,605	7,140	10,710	5,355	1607	3213	5355
2-1/4 x 8	3-1/2"	3.555	80,000	227,551	4,651	4,267	5,333	5,973	6,400	6,699	8,533	12,800	6,400	1920	3840	6400
2-3/8 x 8	3-11/16"	3.985	80,000	255,067	5,503	5,048	6,310	7,067	7,572	7,926	10,096	15,145	7,572	2272	4543	7572
2-1/2 x 8	3-7/8"	4.440	80,000	284,152	6,453	5,920	7,400	8,288	8,880	9,294	11,840	17,760	8,880	2664	5328	8880
2-3/4 x 8	4-1/4"	5.422	80,000	347,033	8,669	7,953	9,941	11,134	11,929	12,486	15,906	23,859	11,929	3579	7158	11929
3 x 8	4-5/8"	6.503	80,000	416,194	11,341	10,405	13,006	14,567	15,607	16,336	20,810	31,215	15,607	4682	9364	15607
3-1/4 x 8	5"	7.682	80,000	491,634	14,513	13,315	16,644	18,641	19,973	20,905	26,630	39,945	19,973	5992	11984	19973
3-1/2 x 8	5-3/8"	8.959	80,000	573,355	18,228	16,723	20,904	23,412	25,084	26,255	33,446	50,169	25,084	7525	15051	25084

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TORQUE GUIDE FOR ASTM **A320** CLASS **L7** GRADE **M** BOLT TENSION BASED ON 90 % YIELD					REQUIRED TORQUE (FtLbs)									*THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN*		
BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN^2)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300 0.15	First Pass **30%**	Second Pass **60%**	All Subsequent Passes **100%**
3/4 x 10	1-1/4"	0.334	80,000	24,069	164	150	188	211	226	236	301	451	226	68	135	226
7/8 x 9	1-7/16"	0.461	80,000	33,228	264	242	303	339	363	380	485	727	363	109	218	363
1x 8	1-5/8"	0.605	80,000	43,591	396	363	454	509	545	570	727	1,090	545	163	327	545
1-1/8 x 8	1-13/16"	0.790	80,000	56,884	581	533	667	747	800	837	1,067	1,600	800	240	480	800
1-1/4 x 8	2"	0.999	80,000	71,942	817	749	937	1,049	1,124	1,177	1,499	2,248	1,124	337	674	1124
1-3/8 x 8	2-3/16"	1.233	80,000	88,767	1,109	1,017	1,271	1,424	1,526	1,597	2,034	3,051	1,526	458	915	1526
1-1/2 x 8	2-3/8"	1.491	80,000	107,358	1,463	1,342	1,677	1,879	2,013	2,107	2,684	4,026	2,013	604	1208	2013
1-5/8 x 8	2-9/16"	1.774	80,000	127,715	1,885	1,729	2,162	2,421	2,594	2,715	3,459	5,188	2,594	778	1557	2594
1-3/4 x 8	2-3/4"	2.081	80,000	149,839	2,382	2,185	2,731	3,059	3,278	3,431	4,370	6,555	3,278	983	1967	3278
1-7/8 x 8	2-15/16"	2.413	80,000	173,729	2,959	2,715	3,393	3,800	4,072	4,262	5,429	8,144	4,072	1222	2443	4072
2 x 8	3-1/8"	2.769	80,000	199,385	3,622	3,323	4,154	4,652	4,985	5,217	6,646	9,969	4,985	1495	2991	4985
2-1/8 x 8	3-5/16"	3.150	80,000	226,807	4,378	4,016	5,020	5,623	6,025	6,306	8,033	12,049	6,025	1807	3615	6025
2-1/4 x 8	3-1/2"	3.555	80,000	255,995	5,232	4,800	6,000	6,720	7,200	7,536	9,600	14,400	7,200	2160	4320	7200
2-3/8 x 8	3-11/16"	3.985	80,000	286,950	6,190	5,679	7,099	7,951	8,519	8,916	11,358	17,038	8,519	2556	5111	8519
2-1/2 x 8	3-7/8"	4.440	80,000	319,671	7,259	6,660	8,325	9,324	9,990	10,456	13,320	19,979	9,990	2997	5994	9990
2-3/4 x 8	4-1/4"	5.422	80,000	390,412	9,752	8,947	11,184	12,526	13,420	14,047	17,894	26,841	13,420	4026	8052	13420
3 x 8	4-5/8"	6.503	80,000	468,218	12,759	11,705	14,632	16,388	17,558	18,378	23,411	35,116	17,558	5267	10535	17558
3-1/4 x 8	5"	7.682	80,000	553,089	16,328	14,979	18,724	20,971	22,469	23,518	29,959	44,938	22,469	6741	13482	22469
3-1/2 x 8	5-3/8"	8.959	80,000	645,024	20,506	18,813	23,517	26,338	28,220	29,537	37,626	56,440	28,220	8466	16932	28220

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TORQUE GUIDE FOR ASTM **A320** CLASS **L7** GRADE **M**

BOLT TENSION BASED ON 99 % YIELD

REQUIRED TORQUE (FtLbs)

THESE TORQUE VALUES ARE BASED ON FRICTION FACTOR IN "CUSTOM" COLUMN

BOLT SIZE DIA. x TPI	HEX NUT ACROSS FLAT	STRESS AREA (IN²)	MIN YIELD STRENGTH (PSI)	BOLT TENSION (LBS)	**LoaDISC** TS 801MOLY K=.109	MOLYBDENUM DISULFIDE K=.100	MOLY/LEAD OXIDE/GRAPHITE K=.125	COPPER & GRAPHITE K=.140	NICKEL & GRAPHITE K=.150	API SA2 K=.157	MACHINE OIL K=.200	DRY STEEL K=.440	CUSTOM (INSERT K) K=.300	First Pass	Second Pass	All Subsequent Passes
													0.15	**30%**	**60%**	**100%**
3/4 x 10	1-1/4"	0.334	80,000	26,476	180	165	207	232	248	260	331	496	248	74	149	248
7/8 x 9	1-7/16"	0.461	80,000	36,551	291	267	333	373	400	418	533	800	400	120	240	400
1x 8	1-5/8"	0.605	80,000	47,951	436	400	499	559	599	627	799	1,199	599	180	360	599
1-1/8 x 8	1-13/16"	0.790	80,000	62,572	639	587	733	821	880	921	1,173	1,760	880	264	528	880
1-1/4 x 8	2"	0.999	80,000	79,136	899	824	1,030	1,154	1,237	1,294	1,649	2,473	1,237	371	742	1237
1-3/8 x 8	2-3/16"	1.233	80,000	97,644	1,220	1,119	1,399	1,566	1,678	1,757	2,238	3,357	1,678	503	1007	1678
1-1/2 x 8	2-3/8"	1.491	80,000	118,094	1,609	1,476	1,845	2,067	2,214	2,318	2,952	4,429	2,214	664	1329	2214
1-5/8 x 8	2-9/16"	1.774	80,000	140,487	2,074	1,902	2,378	2,663	2,854	2,987	3,805	5,707	2,854	856	1712	2854
1-3/4 x 8	2-3/4"	2.081	80,000	164,823	2,620	2,404	3,005	3,365	3,605	3,774	4,807	7,211	3,605	1082	2163	3605
1-7/8 x 8	2-15/16"	2.413	80,000	191,101	3,255	2,986	3,732	4,180	4,479	4,688	5,972	8,958	4,479	1344	2687	4479
2 x 8	3-1/8"	2.769	80,000	219,323	3,984	3,655	4,569	5,118	5,483	5,739	7,311	10,966	5,483	1645	3290	5483
2-1/8 x 8	3-5/16"	3.150	80,000	249,488	4,816	4,418	5,523	6,185	6,627	6,936	8,836	13,254	6,627	1988	3976	6627
2-1/4 x 8	3-1/2"	3.555	80,000	281,595	5,755	5,280	6,600	7,392	7,920	8,289	10,560	15,840	7,920	2376	4752	7920
2-3/8 x 8	3-11/16"	3.985	80,000	315,645	6,809	6,247	7,809	8,746	9,371	9,808	12,494	18,741	9,371	2811	5622	9371
2-1/2 x 8	3-7/8"	4.440	80,000	351,638	7,985	7,326	9,157	10,256	10,989	11,502	14,652	21,977	10,989	3297	6593	10989
2-3/4 x 8	4-1/4"	5.422	80,000	429,453	10,727	9,842	12,302	13,778	14,762	15,451	19,683	29,525	14,762	4429	8857	14762
3 x 8	4-5/8"	6.503	80,000	515,040	14,035	12,876	16,095	18,026	19,314	20,215	25,752	38,628	19,314	5794	11588	19314
3-1/4 x 8	5"	7.682	80,000	608,397	17,960	16,477	20,597	23,068	24,716	25,870	32,955	49,432	24,716	7415	14830	24716
3-1/2 x 8	5-3/8"	8.959	80,000	709,527	22,557	20,695	25,868	28,972	31,042	32,490	41,389	62,084	31,042	9313	18625	31042

Southwest Texas	West Texas	Main Office	Southeast Texas	Central & East Texas
4802 Baldwin Blvd.	3508 S County Rd 1290	12420 Texaco Rd	2484 W Cardinal #4	7900 Rodeo Trl. #500
Corpus Christi 78408	Odessa, TX 78765	Houston, TX 77013	Beaumont, TX 77705	Mansfield, TX 76063
361-888-5080	432-561-8481	713-453-6677	409-840-9699	682-334-2679

REV 7.31.09

This spread sheet is to be used as a guide. all results should be analyzed against actual field results to establish their validity.
To use spread sheet click desired tab for B7 or B16 material
Enter the desired percent yield in yellow field at top of form
If 'K' factor is not listed, Enter appropriate value under Custom (insert K) , in yellow field only
as always- after entering any value, click outside the field or hit enter to update calculations.
NOTICE: Spread sheet is active and unprotected. Any alterations to cells other than those shown in yellow could produce incorrect results.

HYTORC

TORQUE VALUES/FT. LBS. PTFE COATED B-7M (Teflon)

BOLT DIAMETER	NUT SIZE	40%	50%	60%	70%	80%	90%	100%
105,000 PSI YIELD								
1/2	7/8"	25	31	37	43	50	56	62
5/8	1-1/16"	50	62	74	87	99	112	124
3/4	1-1/4"	89	111	133	155	178	200	222
7/8	1-7/16"	143	179	214	250	286	321	357
1	1-5/8"	214	268	322	375	429	482	536
1-1/8	1-13/16"	314	393	471	550	628	707	785
1-1/4	2"	441	551	661	771	882	992	1102
1-3/8	2-3/16"	598	748	897	1047	1196	1346	1495
1-1/2	2-3/8"	788	986	1183	1380	1577	1774	1971
1-5/8	2-9/16"	1016	1270	1523	1777	2031	2285	2539
1-3/4	2-3/4"	1282	1603	1924	2244	2565	2885	3206
1-7/8	2-15/16"	1592	1991	2389	2787	2185	3583	3981
2	3-1/8"	1949	2436	2923	3410	3898	4385	4872
2-1/4	3-1/2"	2813	3517	4220	4923	5626	6330	7033
2-1/2	3-7/8"	3902	4877	5852	6828	7803	8779	9754
95,000 PSI YIELD								
2.3/4	4-1/4"	4741	5926	7111	8296	9482	10667	11852
3	4-5/8"	66200	7751	9301	10851	12401	13951	15501
3-1/4	5"	7933	9916	11899	13882	15866	17849	19832
3-1/2	5-3/8"	9961	12451	14941	17431	19922	22412	24902
3-3/4	5-3/4"	12308	15385	18462	21539	24616	27693	30770
4	6-1/8"	14998	18747	22496	26246	29995	33745	37494
75,000 PSI YIELD								
4-1/4	6-1/2"	14216	17771	21325	24879	28433	31987	35541
4-1/2	6-7/8"	16988	21235	25481	29728	33975	38222	42469