When the global drilling and completion market is stable or on the increase, effective international management of drill strings is relatively simplified. Pipe owners can order replacement strings because oil & gas prices or day rates allow it and there are fewer cost controls to prevent replacement. When the market rapidly declines, we all find ourselves under increased scrutiny and cost control.

It can be extremely tempting to consolidate drill strings, whether drill pipe, HWDP or collars - but particularly drill pipe - to meet contract requirements and avoid new purchases. Unfortunately, that frequently results in errors, confusion and questionable, mingled performance properties. In addition, drill strings are more likely to be shipped across international borders, as we try to manage inventories and avoid purchasing replacement pipe by transferring material to other country operations or rigs.

Today, pipe’s higher performance requirements for rotary steerable applications, ERD wells, optimized time to TD, and well tortuosity demand greater pipe management integrity through optimum inspection, serialization, record keeping and maintenance. Mingling drill pipe strings can result in loss of traceability to original material test reports and downgrading of the pipe to lower performance criteria. This results in lost revenue and balance sheet write downs. An effective drill string management program is critical to maintaining integrity, keeping this critical asset at full book value and with full confidence in its performance. Such a program should contain, as a minimum, the following recommended elements:

**Material Test Reports** (MTRs - mill certificates or documentation packages) which reports the pipe body and tool joint properties, traceable by joint serial number and heat number. This should include all material properties required by DS-1®. It should be maintained in multiple locations, at least one digitally and accessible globally; and a second in printed format at the pipe location, rig, or pipe yard. When drill strings are shipped internationally, a complete copy of the original MTR package should be shipped with the import-export documents, even if it is moving with the rig. Details of the minimum requirements are in DS-1.

Continued on Page 4
We at T H Hill continuously strive to improve the quality of Standard DS-1 both based on feedback from the industry and from our own research and development. Studies have proven that more specific procedures and acceptance criteria for inspection processes will lead to higher quality control which minimizes the risk of failure. As part of this effort, several modifications and updates have been made to Standard DS-1, Fourth Edition, and new standards have been developed as well.

**STANDARD DS-1® UPDATES**

From its inception, T H Hill has shaped the inspection processes in the oil and gas industry. Volume 4 of Standard DS-1, Fourth Edition addresses specialty tools with specific requirements for different tool families. In the most recent addendum to Standard DS-1, Fourth Edition, detailed procedures and acceptance criteria have been added for completions tools, including sub-surface safety valves and frac sleeves. As part of the common inspection methods for these completions tools, the visual and dimensional inspection of API round-thread connections is addressed as is drift testing.

Standard DS-1, Fourth Edition currently covers the inspection of nearly all drill stem equipment (including specialty tools) in Volumes 1, 3, and 4. However, there was little to no coverage for drilling bits, even though these are considered to be part of the drill stem. For this reason, T H Hill has developed the DS-1 Bit Inspection Technical Standard (BITS) as a standalone supplement to Volumes 3 and 4 of Standard DS-1, Fourth Edition. The DS-1 BITS addresses the unique inspection procedures and acceptance criteria that apply to drilling bits.

The DS-1 BITS includes two separate service categories: new bits and used bits. This simplifies the inspection process for the operator, manufacturer, and/or inspection company. To understand the various aspects of different types of drilling bits, an entire chapter is mostly dedicated to pictorial and written definitions. Acceptance criteria are determined based on the service category and are provided in text within the body of the standard. Following the acceptance criteria are specific procedural steps for each inspection technique.

Beyond this, the DS-1 BITS features some very unique characteristics as well. In an effort to improve the simplicity of the standard for an inspector, all acceptance criteria have been tabulated with photographs of actual bits, showing what is acceptable and what is rejectable. An example of such a table is shown. With this feature, the DS-1 BITS acts as an easy-to-use, comprehensive inspection standard for drilling bits, with a level of detail that had previously never existed in any international specification.
T H Hill will soon be releasing the Standard TS-1™ “Manufacturing Specification of Drill Pipe for Sour Service Application.” This specification outlines manufacturing (material, testing, dimensions and inspection) requirements for normal weight drill pipe joints used in a sour service environment. Manufacturing drill pipe joints to this specification will enhance the material properties which will help mitigate sour service drill pipe failures. The material requirements may also help to improve sour service life. Standard TS-1 has two pipe grades: TS-95 and TS-105 with minimum yield strength 95 ksi and 105 ksi, respectively, while the tool joints are made of 110 ksi minimum yield strength material. Currently, the manufacturing of sour service drill pipe is not covered by any API specification. This standard enables manufacturers and users to standardize on an industry-wide set of attributes for the manufacturing of sour service drill pipe.

If you registered your copy of the Standard DS-1 you will soon be receiving more information on DS-1 BITS and Standard TS-1. If not, contact us or click here. More updates are coming soon!

**TRAINING: DS-1® CERTIFICATION**

The Standard DS-1® ensures the quality of inspection and qualification work when followed correctly. The 2-day DS-1 Volumes 3 & 4 training course will familiarize inspectors and vendor personnel with what’s in the books, how to find the information they need, and why those procedural requirements are important.

We cover the popular inspection categories in DS-1 Volume 3 for both BHA components and drill pipe. Every detail about the structure of the volume is laid out, and the individual requirements are highlighted and discussed. More than that, the actual inspections are practiced with hands-on equipment to make sure that both the inspection procedures and the acceptance criteria can be pulled from the standard’s pages. The student will be able to navigate and use Volume 3 for any inspection category or procedure that is required.

Volume 4 is different, both in structure and purpose, so the students will learn exactly where the information is and how to use it for various types of specialty tools. The class will go through the overarching patterns and the specific requirements in detail, teaching navigation and use along the way. We apply that knowledge to the inspection of several different types of tools, highlighting the important steps to take in each case.

Each student receives a copy of DS-1 Volumes 3 & 4, and successful students will have worked hard to understand and apply the standards that they get to keep. As such, we think it fitting that every student who passes the final examination will be awarded a DS-1 Training Certificate that lets the world know they’ve been through the training and proved to the T H Hill instructor that they’ve mastered the material.
**Inspection quality** is essential. Accumulated fatigue is invisible until a detectable crack propagates. Offshore rigs are likely to move from one region to another or drill wells closer to the rig capacity. Attempting to save a small amount of money by lowering DS-1 drill pipe inspection categories can be tempting. However, by utilizing the higher Cat 5 criteria, slip area, transition area and tool joint failures are far less likely and the resultant culling of questionable pipe prevents future NPT. (However, see Note 2 to Table 2.2 of DS-1 Volume 3.) This benefits both the contractor and the operator. Ensuring that the inspection is performed in accordance with DS-1 is a job for trained and experienced quality assurance technicians.

**Inspection reports** of the most recent inspections report performed to the DS-1 standard, regardless of category, should be kept. These should refer to the same serial numbers as the original MTRs. During an inspection, joints are generally renumbered sequentially. This numbering is temporary and must be cross-referenced back to the original serial numbers. Again, maintain this cross-reference in multiple locations, with the MTRs, using the original serial numbers as the parent or master numbering. Insist that final inspection reports use the original serial numbers, not temporary inspection numbers.

**Recutting of connections** can result in the loss of tool joint serial numbers. These should be replaced with new, permanent stamps to identify the original serial numbers. Ensure that the correct stress relief features [stress relief grooves on pins and bore-backs on boxes] are accurately re-machined, per DS-1, onto BHA connections. Cold rolling is preferred, whenever possible. Never accept recutting a connection without an SRF that used to have it.

**Hardbanding** must be re-applied from time to time, at a frequency dependent upon formation abrasion, RPM, WOB, hole angle, casing size, drilling vs sliding, time and other factors. The original hardbanding may not always be available in a local country and it is important to understand that not all commercially available hardbanding types are compatible. Contact T H Hill if you are unsure of compatibility. Most importantly, document the original hardbanding type, subsequent overlays and each re-application. Field hardbanding can incur issues in cold or windy weather and should be adequately supervised. Only re-hardband following an approved welding procedure specification and procedure qualification record that is adequately documented, per section 3.22 of DS-1, Volume 3.

**DS-1 criteria** must be strictly applied for necessary repairs during inspections to avoid shortening pipe life by unnecessary recuts. The criteria for thread pitting in DS-1 is under review, with T H Hill Finite Element Analysis (FEA) which will potentially lead to longer time before recut. Although shoulder seal areas are critical, too many connections are unnecessarily repaired due to misapplication of the criteria in DS-1. Ensure that inspections utilize the criteria for internal plastic coating classification in DS-1, Volume 3, section 3.4.5. Used pipe can be internally re-coated but only before allowable corrosion pitting is exceeded. Certain completion fluids and well testing can permanently damage internal coating.

**Maintain drill strings** that are stored or unused. Thread compounds on connections will dry out during storage. Rain water collects in protectors. Harsh storage conditions exist in many pipe yards close to the ocean, with high atmospheric corrosion. Although pitting in drill pipe thread roots is being reviewed, shoulder seal areas are critical and thread dope often dries out first on the seal areas. Apply a light, corrosion inhibiting external coating to pipe that
is stored for extended periods. Clean and re-dope connections before they dry out, dependent upon local conditions. Re-apply the original nominal pipe size, grade, weight, connection and serial numbers with accurate paint stenciling.

**Document**, document, document. Drill string components sometimes are imported into a country with a rig, or for a specific project, and then can be left in-country after the rig leaves or the project is completed. Re-export generally requires certification as to country of origin, import history and material certification, i.e., MTRs and inspection reports. Customs authorities in many countries will not allow re-export without these detailed records. T H Hill can help assemble and maintain detailed records and in some cases provide re-certification of country of origin and material test reports.

It can be a time consuming task to effectively maintain the integrity of drill string components, not just in terms of inspections and repairs but also the critical associated documentation. Failure to perform either can result in non-conformance to specifications or stranded inventory in a no longer active country. Either of these can result in lost revenue or written-off assets. Drill string components are expensive assets and critical parts of well construction. Maintaining them properly is an important, but often overlooked, necessity.

---

**CHECK OUT OUR APP!**

T H Hill has always provided our customers with the tools necessary to prevent failures, from complex inter-disciplinary engineering design to experience-based recommendations. We’ve recognized the need for drilling people to have the right information at their fingertips for making decisions that will affect the structural integrity of their string, and we’re working to provide you with those very tools.

As part of that, we’re proud to offer our free Drillstring Toolbox app that runs on iPhone®, iPad®, and Android™ devices. It allows you to quickly and easily find the makeup torque for your drill stem connections, no matter the size or component. Not only that, the app will give you the tensile capacity for the connection when made up to the API-recommended makeup torque. You can also find the tensile and torsion capacity for typical sizes, weights, and grades of drill pipe tubes.

The Drillstring Toolbox app puts the information to help you prevent failures within your reach—in your pocket, in fact.

*The Apple logo, iPhone, and iPad are trademarks of Apple Inc., registered in the U.S. and other countries. App Store is a service mark of Apple Inc. Android, Google Play and the Google Play logo are trademarks of Google Inc.*
With over 30 years of experience in QA/QC and drilling engineering, we have accumulated a wealth of knowledge to share with operators, drilling contractors and vendors. Our classes are offered publicly around the world, or we can arrange private classes at your facility.

Learn more about our training opportunities or register for the above public classes.

We’ve Moved

As of July 1, 2016, our office has relocated. We are joining our parent company, Bureau Veritas, in this new location. Combining our teams allows us to further expand the integrated solutions we offer to our clients in all sectors of the oil and gas industry.

Our new address is:

16800 Greenspoint Park Drive
Suite 300S
Houston, Texas 77060 USA