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Application of Storage & Thread Compounds

Recommended doping procedures in preparation for long-term storage or for running tubing, casing, line pipe and drill string connections.

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NEW REVISION OF API RP 5A3 PENDING ADDS MORE TO CORROSION RESISTANCE TESTING

Thread Compounds for Casing, Tubing, Line Pipe, and Drill Stem Elements

API RECOMMENDED PRACTICE 5A3
FOURTH EDITION, JANUARY 2023

API American Petroleum Institute

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Annex L
(informative)

Corrosion Inhibition Tests

L.1 Introduction

The storage compound manufacturer is responsible for determining the relative corrosion resistance of compounds. For full-scale tests of storage compounds for connections, industry consensus has been achieved. Storage compound manufacturers, tubular connection manufacturers, and users are encouraged to continue developing alternative panel test methods until correlation with full-scale tests and industry consensus occurs.

L.2 Corrosion Test Methods

L.2.1 General

The API has carried out investigations of connection storage compounds through both full-scale tests of drill pipe connections and lab panel tests. Because full-scale tests simulate real year-round field conditions by capturing all four seasons, its results provide reliable storage compound recommendations for pipe yard storage of connections for users. For lab panel tests, the ASTM B117 2000-hour panel test is an industry acceptable method to predict performance of long-term storage and thread/storage compounds.

Initial long-term panel tests (ASTM B117 for up to 2000 h) were used for selection of full-scale test storage compounds, to verify corrosion protection properties and provided enough correlation for successful full-scale testing. This panel test also has some limited correlation to field performance of storage and thread/storage compounds. Engagement of plastic thread protectors reduces the correlation, as it creates crevice conditions; there is some static charge from the plastic and other thin film issues in the load side of the threads.

L.2.2 Full-Scale Test Procedure for OCTG and Drill Pipe Applications

L.2.2.1 Purpose

This full-scale test procedure is used for applying storage and thread/storage compounds to connections before pipe is placed in storage. The objective is to ensure that connections are stored properly with a compound and procedure that will assure the longest corrosion resistance possible for the full-scale test. This procedure applies to new carbon steel connections that are placed in storage for the full-scale test. A minimum of five pin by box pup or full-length joints shall be used for the full-scale corrosion-inhibition tests.

L.2.2.2 Storage and Thread/Storage Compound Qualification Test

The ASTM B117 panel test, which is outlined in L.2.3.2, is used to select and compare storage and thread/storage samples for the full-scale test.

L.2.2.3 Connection Surface Preparation

Connection surfaces need to be free of moisture and contaminants prior to the application of storage or storage/thread compound. Steel corrosion processes are the result of an electrolytic action that requires both water and dissolved ions (chlorides, sulphides, sulphates, and other negative or positive charged ions) to act together as

1. COMPOUND PREPARATION AND CONTAMINATION:

- Upon opening the container, the product should be stirred with either a clean dope brush or other suitable device to re-blend any oil separation or settling of the component solids that may have occurred during shipment and storage. It will also soften most greases a bit to allow for better flow properties, particularly if the compound is intended for mechanical seal connection designs. Stirring is critical for high density materials such as lead and zinc, and for high temperature (>90°F) storage conditions.
- Care should be taken after opening the container, so no contamination of the compound in the container occurs, i.e. drilling fluids, water, dirt and other debris. NEVER add any material such as diesel fuel, kerosene, motor oil, etc., to the compound to improve the ease of application.
- Contamination or adulteration of the compound can lower the galling resistance properties and change the friction factor of the compound, as well as interfere with the storage capability of the product on connections.

2. CONNECTION SURFACE PREPARATION FOR STORAGE:

- In preparation for storage, water and cutting fluids must be removed for long storage success. The use of a moisture displacer is a valuable first step prior to application of a storage or running and storage compound. This product should be blown off to aid in the removal of water and cutting fluid residue.
- Ensure the storage product is applied thoroughly with full coverage of the threads and especially the pin nose.
- Before applying the thread protector, a good practice would be to apply the storage product inside the thread protector in the pin nose area to ensure an adequate seal. This also ensures as the pin is engaging in the thread protector the storage product is not wiped away before it is completely and firmly tightened to the manufacturer’s required torque.
- When the thread protector has been tightened there should be compound extruding from the thread run out area toward the body of the pipe. This ensures a better seal against moisture intrusion.
- Do not use a standard dope brush on mechanical seal connections to apply the storage compound.

INSPECTING CONNECTIONS IN STORAGE:

- While connections are in storage; plastic thread protectors can expand more than the metal, resulting in loosening over time. During the heating and cooling cycles moisture in the form of rain or humidity can enter the thread protector. This can result in moisture absorption in the storage compound over time, which in turn can shorten storage protection depending upon the type of thickener used in the storage grease.
- Running compounds typically have a shorter storage capability than storage products. Solid lubricants can allow the absorption or retention of moisture in the product or open channels for the moisture to reach the metal surface, thus resulting in rust and corrosion. Additionally, material such as graphite can couple with the static charge generated in the plastic to form a galvanic cell and result in pitting.
- During storage, pipe with storage or running compounds should be inspected at intervals such as 3 months. The inspection need not be all the pipe but a few ends from various points in the stack. Once inspected reapply the storage compound to the pin nose area of the thread protector and retighten. Do not inspect the same connections at each inspection interval. If corrosion starts to appear all the connections will need to be cleaned, inspected, and re-coated with new compound. Ensure any thread protector re-used is cleaned and dry before re-use.

2B. SURFACE PREPARATION FOR RUNNING COMPOUNDS:

- All connection contact surfaces should be cleaned and free of storage or prior running compound, drilling fluids, and any other contaminant residues prior to the application of the compound. Contaminant residues, when mixed with the thread compound during connection engagement can substantially change the friction factor and galling resistance of the thread compound.
- Ensure connections were cleaned to free up debris/contaminants, which may consist of rust, grease, and/or loose scale. A small amount of moisture in most cases is unavoidable and will not affect compound running performance.

- **If the connections are mechanical seal designs and specifically corrosion-resistant alloys such as 13-25% chrome, Inconel, etc, NEVER USE A WIRE BRUSH TO CLEAN.**

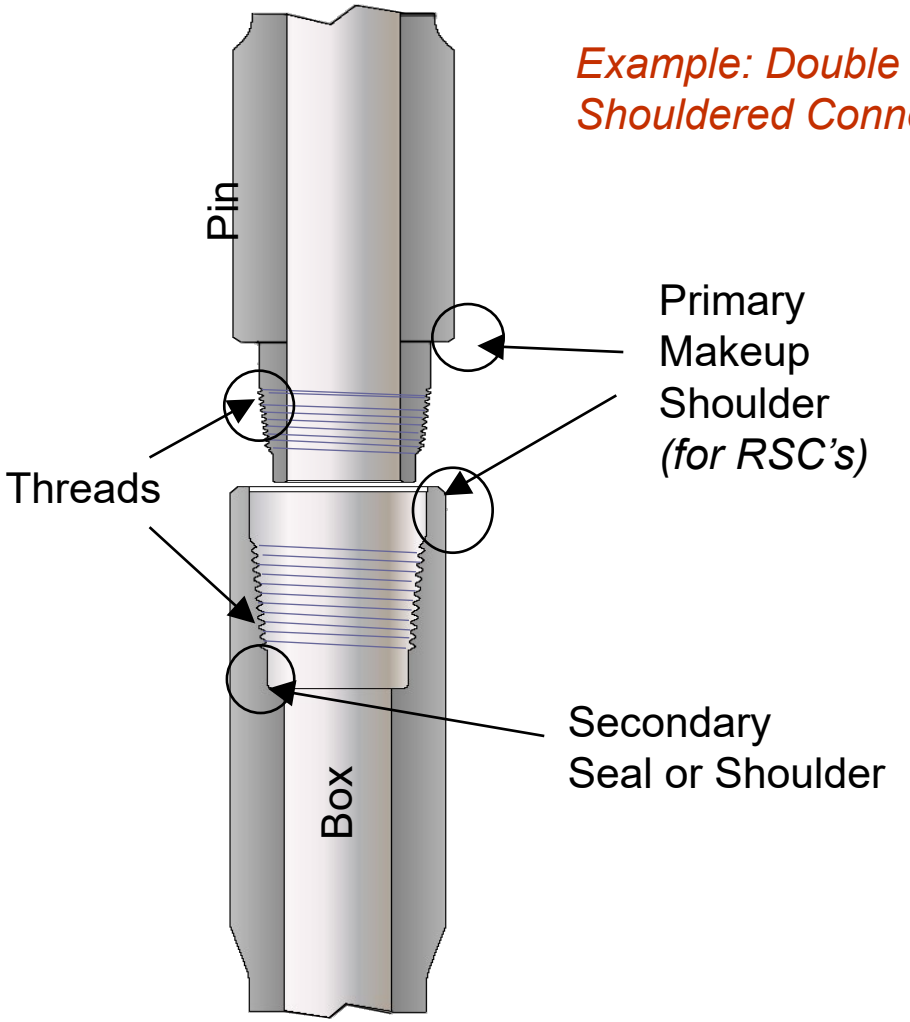
3A. COMPOUND APPLICATION:

- **Running Compound Application to Thread Seal Connection Designs such as 8-Round and Buttress:**
  - The thread compound should be applied uniformly to the entire contact surface of either the pin or box. On galling prone alloys such as L-80 doping the box as well as the pin can be beneficial. The practice of slapping a "gob" of pipe dope on one side of the pin or box and depending on the pipe rotation during make-up to distribute the compound over the connection surface is bad practice and not sufficient.
  - The compound must be worked into the thread roots and should completely cover the surfaces, filling root to thread on the pin or box. Ensure the make-up equipment is in proper alignment and take measures necessary to avoid pin nose and stabbing damage.

3B. COMPOUND APPLICATION:
Mechanical Seal Connection Designs such as VAM TOP, Tenaris Blue, Hydril Wedge, etc

- Typically standard “Dope Brushes” are prohibited on mechanical seal design connections. “Mustache” brushes are required to ensure brush hairs to not fall out and interfere with the seal or thread and seal face contact pressure requirements. The thread compound should be applied uniformly to the entire contact surface of both the pin and box (Even the imperfect threads and the machined ends such as ring, seal, bore, face).
- Typically the box will use 2/3 the required quantity listed by the connection designer and the pin will receive the other 1/3. The practice of slapping a "gob" of pipe dope on one side of the pin or box and depending on the pipe rotation during make-up to distribute the compound over the connection surface is bad practice and **PROHIBITED!**
- The compound must be worked into the thread roots and should completely cover the surfaces. Filling root to thread is bad practice on many mechanical seal designs as this can lead to compound entrapment and hydraulic cell development. This can lead to galling and loose connections. Ensure the make-up equipment is in proper alignment and take measures necessary to avoid pin nose and stabbing damage.

WHERE MUST THREAD COMPOUNDS BE APPLIED?



Example: Double Shouldered Connection

- Coat Primary Shoulder on interference connection designs.
- Fill Threads, only root to crest.
  - Too much compound can interfere with connection make-up, too little may result in galling.
- Coat secondary shoulder or seal area on applicable connection designs.
- Ensure the connection is as free of drilling fluid as possible. Rinsing may be required.

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WHAT QUANTITY OF THREAD COMPOUND IS REQUIRED ON ROTARY SHOULDERED CONNECTIONS?

Insufficient Thread Compound coverage Rotary Shouldered Connections

Proper Thread Compound coverage for Rotary Shouldered Connections

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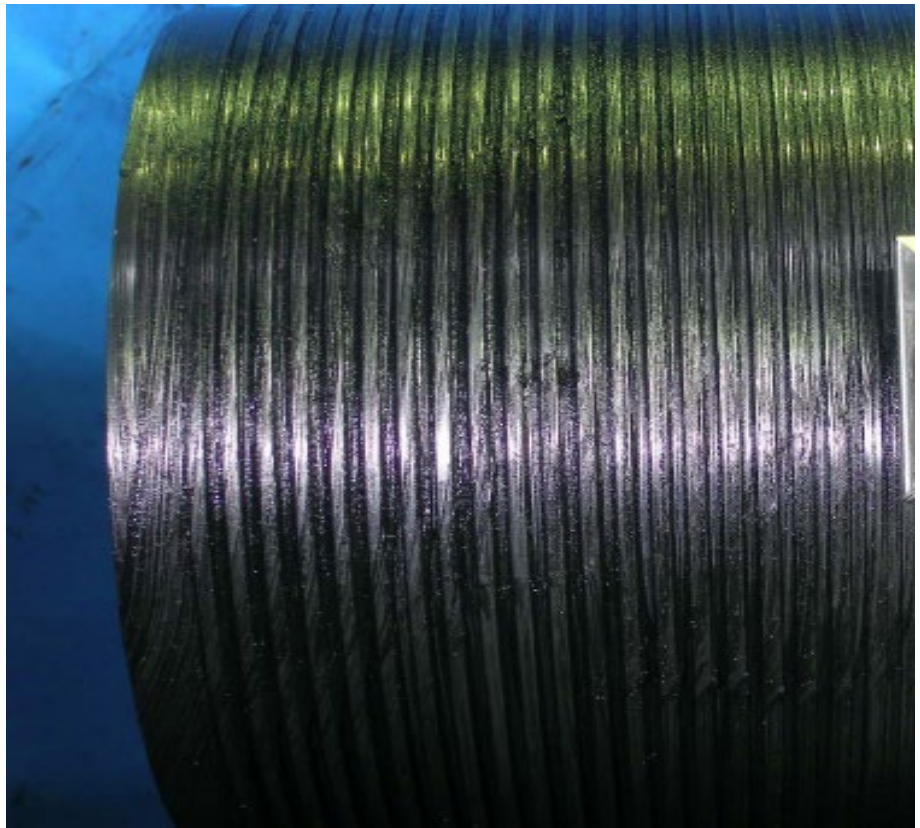
WHAT QUANTITY OF COMPOUND IS REQUIRED ON API & OTHER THREAD SEAL CONNECTION DESIGNS

Insufficient Thread Compound coverage for 8-Round or Buttress Connections



Excess Thread Compound coverage for 8-Round or Buttress Connections

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PROPER QUANTITY OF THREAD COMPOUND ON MECHANICAL SEAL CONNECTION DESIGN

Insufficient Thread Compound coverage for 8-Round or Buttress Connections

Excess Thread Compound coverage for 8-Round or Buttress Connections

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“DOPE” BRUSHES

The Standard “Dope” Brush to Apply Thread Compound to API Rotary Shouldered, 8-Round and Buttress Connections on 4140 and Other Less Galling Prone Alloys

MECHANICAL SEAL CONNECTIONS

NO WAY!!!

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MUSTACHE BRUSH

The Proper Brush to Apply Thread Compound to Mechanical Seal Connection Designs on Chrome and Other Galling Prone Alloys

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THREAD COMPOUND USAGE

DRILL COLLAR/TOOL JOINT/CASING/TUBING

DRILL COLLAR & TOOL JOINT SIZE	JOINTS* PINS/GAL
4 1/2"	51
5"	46
5 1/2"	42
6 5/8"	34
7"	30
7 5/8"	23
8 5/8"	17
9 5/8"	14

TUBING SIZE	JOINTS* PINS/GAL
2 3/8"	194
2 7/8"	160
3 1/2"	128
4"	114

CASING SIZE	JOINTS* PINS/GAL
4 1/2"	68
5"	61
5 1/2"	55
6 5/8"	46
7"	44
7 5/8"	40
8 5/8"	35
9 5/8"	32
10 3/4"	28
11 3/4"	26
13 3/8"	23
16"	19
18 5/8"	16
20"	15
26"	12
36"	9

* When applying compound to one LT&C pin or box, filling root to crest.

-A 10 pound pail of **RUN-N-SEAL®** is 1.0 gallon.
-For short thread, multiply by 1.2.
-If both pin and box are doped, multiply compound ounces by two or divide pins/gallon by two.

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