Torque Turn Tests on Q-Slip Sleeve holding down screws Ref: RP/2014 Eng. Jan - 001-A

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A High level Look in to the holding forces from a grub-screw locking mechanism Author- Marco Kacgin - Ruma Products BV Holland 2014

The Effects of Grub Screw orientation on a slip on sleeve holding forces

Content

Pre-Amble

A potential Customer requires that his simple sand-screen construction be retrievable by work-over to enable clean ups of the well to occur. As this process requires that the screens be rotated to allow washing and removal it is necessary to have to mill the sleeve so as to gain access and be able to rotate the screen. The proposed mill will be a wash-over type mill. This requires the Sleeve to be or to remain fixed to the base-pipe and NOT to rotate during milling as this would make milling impossible. While we have had extensive test to measure and document the sleeve holding forces none of these test have been conducted with the rotational forces created during milling.

This proposed test was set up to try to gauge the rotational torque required to achieve slip between the sleeve and the base-pipe. These tests were conducted using a Torque Turn Makeup Tong Bucking Unit at Bakker Pipe shop in Coevorden.

1.0 Test as Conducted

1.1 Planned Test program

1. Note that this test is to be recorded and reported in a formal report for customer use. Ensure that all information is available as outlined and that all data and information is correct and supported with documentary proof. For this test nothing is *"good enough"*. It has to be as correct as possible. If in doubt please contact
2. Ensure all parties are aware of the test program and the reasons why steps are being taken.
3. View the proposed test set up and ensure that the correct placing of the test sleeve on the pup joint is achievable. The dies are approximately 20 cm wide so spacing must conform. The minimum distance between holding and torque point is 2 foot.
4. Create and approve pipe and sleeve configuration drawing.
5. Check that the power tong and clamping low stress dies are clean and sharp, replace if in doubt.
6. Check that the correct jaws (5,625 inches 142.875mm) are available and fitted for the pieces to be torqued up.
7. Check that all grub screws are new and correct and that there are sufficient for the full tests along with bits for torque.
8. Check the calibration of the power tong unit is up to date.
9. Check that the tong operator knows, what is required and what needs to be done.
10. Ensure all parties are aware of the safety requirements, location of safety equipment and emergency procedures.
11. Record all technical details of the Power Tong Unit.
12. Check and confirm the pup joint is correct and that the grade is correct.
13. De-grease the inside of the test piece and also the area on the pup-joint to be used for the tests.
14. Mark the base pipe with an indelible line as a formal reference point.
15. At the area that the dummy sleeve is to be installed measure and record the Outside Diameter using a pi band
16. Working from the reference point at steps of 45 degrees record the diameter using a calibrated calliper. This is to try to measure and recreate on paper the actual ovality of the pipe based upon the reference point.
17. Prepare test piece, check that all the grub screws are new and can be easily installed and screwed into the test piece.
18. Check that torque wrench has the correct torque setting and note its technical details.
19. Hand tighten the grub screws down to the pipe as evenly as possible,
20. Torque alternating screws at 180 degree. Stepping up to full value.
21. Mark the sleeve and the base pipe.
22. Measure the height of the sleeve to the base pipe at 4 points 90 degrees apart from the base line on both sides of the sleeve .
23. Inject the locking agent into the sleeve and allow sufficient time to cure correctly.
24. Install the test piece in the Torque unit.

1.2 Test Configurations

The tests being conducted were a number of different tests at the same time each with a different testing intension.

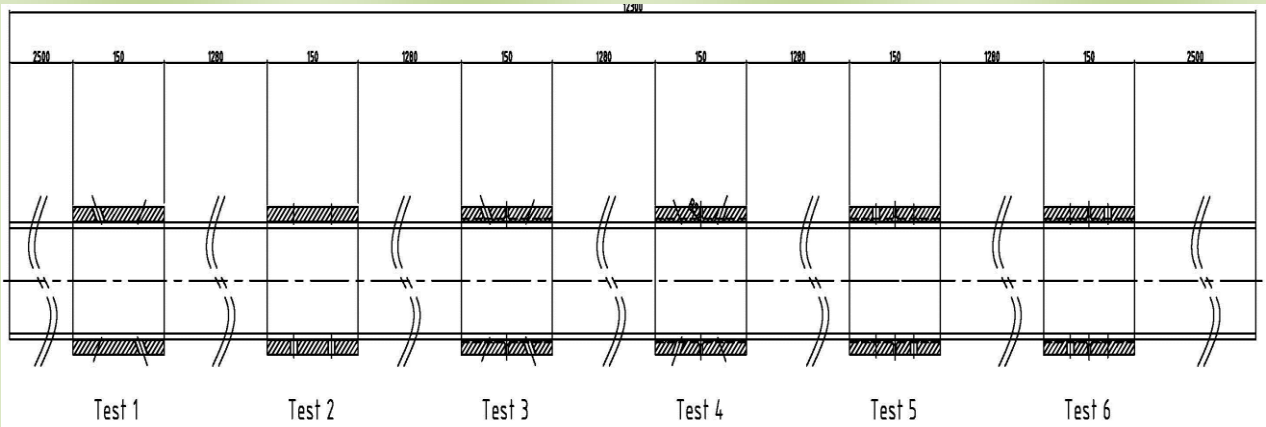
Test Nr	Grub Screw Angled	Grub Screw at Right Angles	Loctite	Otto Epoxy	Bonded Rubber Guides	Ring OD 5,5 inch ft/lbs	Pipe OD 4,5 Inch ft/lbs	Performance Percentage
1	**YES**					4023	4917	125%
2		**YES**				3216	3931	100%
3	**YES**		**YES**			5944	7265	185%
R-3	**YES**		**YES**			7820	9558	243%
4	**YES**			**YES**		5115	6252	159%
5			YES			5690	6954	177%
6				YES		4208	5143	131%
7					YES	5072	6200	158%
R-2		**YES**				4017	4910	125%
R-5			**YES**			7460	9118	232%

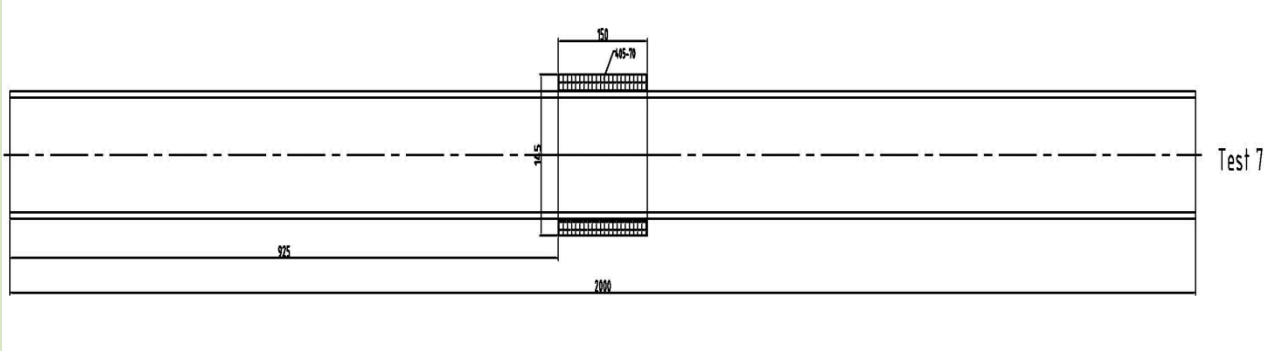
Test Nr	Comments
1	Test with Standard Oblique running guide angled grub screws
2	Test with Industry Standard Perpendicular grub screws
3	Test with Angled grubs screws with Loctite between Pipe Body and Grub Screw body
R-3	Repeat of Test 3 due to maximum torque value of bucking unit. (Test value max slipping)
4	Angled Grub screws with Otto Epoxy instead of Loctite
5	Without Grub screws but with only Loctite Epoxy Locking method (Test value max slipping)
6	Test without Grub screws but with only Otto Epoxy as Locking method
7	Bonded Elastomer instead of Steel Body and Loctite (Test value max slipping)

Test on Short Pipe 2 meter configuration

8 (R-2)	Repeat of Test 2 due to confirmation of value on another Diameter Bucking program
9 (R-5)	Repeat of Test 5 due to Testing with Sleeve not chemically cleaned

1.3 Test Configuration Drawing





1.4 Test Torque Turn Bucking Unit

2.0 Results

Due to operational constraints the bucking unit was operated in the reverse direction to how it was originally proposed for the tests. The test was proposed with the intent of rotation the pipe and holding the sleeve section. For the actual test the reverse was done i.e. hold the pipe and rotate the sleeve section. Additionally there were constraints on the maximum torque values achievable due to the characteristics of the bucking unit.

2.1 Torque values of the thread

The following selection from the Connection Data Sheet shows the sorts of values that are needed for the correct making up of the thread. See “Torque values” section under.

VAM TOP

Connection Data Sheet

OD	Weight	Wall Th.	Grade	API Drift	Connection
4 1/2 in.	11.60 lb/ft	0.250 in.	L80	3.875 in.	VAM® TOP Tubing

PIPE PROPERTIES	
Nominal OD	4.500 in.
Nominal ID	4.000 in.
Nominal Cross Section Area	3.338 sqin.
Grade Type	API 5CT
Min. Yield Strength	80 ksi
Max. Yield Strength	95 ksi
Min. Ultimate Tensile Strength	95 ksi

CONNECTION PROPERTIES	
Connection Type	Premium T&C
Connection OD (nom)	4.902 in.
Connection ID (nom)	3.952 in.
Make-up Loss	3.222 in.
Coupling Length	7.44 in.
Critical Cross Section	3.338 sqin.
Tension Efficiency	100 % of pipe
Compression Efficiency	100 % of pipe
Internal Pressure Efficiency	100 % of pipe
External Pressure Efficiency	100 % of pipe

CONNECTION PERFORMANCES	
Tensile Yield Strength	267 klb
Compression Resistance	267 klb
Internal Yield Pressure	7780 psi
External pressure resistance	6360 psi
Max. bending with sealability	30 °/100 ft
Max. Load on Coupling Face	144 klb

TORQUE VALUES	
Min. Make-up torque	3500 ft.lb
Opti. Make-up torque	3880 ft.lb
Max. Make-up torque	4260 ft.lb

These values indicate the levels that would limit the milling of the Sleeve. If the Sleeve were to rotate with a value lower than these then milling would not be technically possible. These are important because the overshot mill would have to mill with lower values than these because of the danger of over torqueing the threads or releasing of the connection.

2.2 Torque Values achieved

Torque is measure of force and a distance. We have all used a spanner where something refuses to release so we add more length to the spanner or use a hammer to increase the instant force to try to release the nut or bolt. During the tests the Bucking Unit operator in attempt to increase the torque values did this by using another Tubing Diameter. However this means that the resulting force is altered by the different lengths (Diameter) being used by the operator. These therefore have to be corrected to a standard value. For these standard Items I have corrected to show either Tubing fixed and sleeve rotated or Sleeve Fixed tubing rotated. These have been tabulated below:-

Test Nr.	Program Tube Diameter	Final Torque ft/lbs	Unit OD 5,5 inch ft/lbs	Pipe OD 4.5 inch ft/lbs
1	9,625	2299	4023	4917
2	4,500	3931	3216	3931
3	4,500	7265	5944	7265
3a	5,000	8602	7820	9558
4	5,000	5627	5115	6252
5	5,000	6258	5690	6954
6	5,000	4629	4208	5143
7	5,000	5580	5072	6200
8 (R2)	9,625	2295	4017	4910
9 (R5)	5,000	8206	7460	9118

Please bear in mind in the above results that the effects of the swelling/swollen rubber are not being shown, they will only increase the above values, not decrease them.

3.0 Conclusions

A number of conclusions can be drawn from the test results obtained:-

3.1 For the Original Intent of the tests

- All the results irrespective of configuration show release values well in excess of that used to make up the 4 ½ inch threads.
- Milling can be conducted as a recovery method.

3.2 For the additional Configuration Tests

- The use of the torque turn machine works well as a means of comparison between differing test configurations.
- Figures seem to indicate that for rotational forces angled and Perpendicular screws do not show differing performance.
- Use of a bridging glue will always improve rotational values.
- Bonded Rubber Seals have a locking performance in excess of other methods.

4.0 Recommendations

- Advise Customers that Milling is Possible
- For known applications where milling should be required to also use a Locking Glue to raise the torque value further

5.0 Authorisation

Author	Signature	Date
Approved Technical	Signature	Date
Publication Level	Signature	Date
General Circulation Limited Circulation Company Confidential CONFIDENTIAL		

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