VAM® FIELD PROCEDURE

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<td>V2.3</td>
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Modified by: Fabien CARROIS [RDPC](1)
Verified by: Céline SCHES [RDPC](1)
Approved by: Bruno LEFEVRE

(1)R&D PC: Research & Development for Premium Connection (V&M Oil & Gas Division)

Thank you for using Vallourec Drilling Products products.

Vallourec Drilling Products is committed to provide its customers with high quality products.

Vallourec Drilling Products products are developed following very demanding internal procedure aimed to reach our only goals: customer satisfaction and high performance drilling product supply.
Disclaimer

This procedure defines the preparation and precautions to take when running drill pipe with VAM® EXPRESS connections. It is divided into three sections: Product Description, Rig Site Procedures & Inspection and Repair Procedures.

Vallourec Drilling Products reserves the right to change parts or the entire content of this document.

The official version of this document can be downloaded from the Vallourec Drilling Products website (http://www.vamdrilling.com)

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For more information on VAM® Connections and V&M Tubes Steel Grades, please visit www.vamdrilling.com.

VAM® Field Service and Vallourec Drilling Products Engineers are available worldwide to assist with handling and running supervision at the rig site. For details of your nearest VAM® Field Service Centre, please call +44 1224 279 340 or visit www.vamdrilling.com.

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- Molykote® is a registered trademark of Dow Corning Corporation,
- Scotch-brite® is a registered trademark of 3M.
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1 Safety and Environment

1.1 Lifting, Stepping and Handling the pipe

People in charge of lifting, stepping or handling operations have to follow basic safety rules by using personal protective equipment and not standing under heavy loads.

1.2 Thread Compound Recommendations

Vallourec Drilling Products is concerned about the use of its products on the field and their environmental impact.

Please follow Vallourec Drilling Products recommendations regarding quantities and application procedures for thread compounds.

Use of thread compounds on Vallourec Drilling Products products is required to guarantee safe operations and good product performances.

2 Product Description

VAM Express is a double shoulder high torque drill pipe connection. The high torque capability is achieved by increasing the area of the torque shoulders by reducing the thread taper compared to VAM EIS or API drill pipe connections. Of course by changing the thread taper the connection is not compatible with other drill pipe connections. The thread taper is optimized to allow larger torque shoulders while still allowing easy stabbing without the need for stabbing guides. In addition to the change in thread taper the thread profile is also modified.

To date, tool joints are available for drilling operations in 120 ksi and above material, or for sour service in 105 to <120 ksi material. VAM® EXPRESS connections outperform API connections even with lower strength steel. This means that they are ideal for sour service conditions.
Figure 1. Torsional strength comparison between API vs. VAM® EXPRESS tool joints

Figure 2. Tensile strength comparison between API vs. VAM® EXPRESS tool joints
The words used in this procedure are shown on the following sketch:

![Drill pipe description](image)

**Figure 3. Drill pipe description**

Note: Primary shoulder is also called external shoulder; secondary shoulder is also called internal shoulder.

Below sections through a VAM® EXPRESS connection:

![VAM EXPRESS general presentation](image)

**Figure 4. VAM® EXPRESS general presentation**
3 Rig Site Procedures

3.1 Inspection on arrival at rig site of new drill pipe

When the drill pipe arrives at the rig site, the first thing to do is to check that the pipe delivered is the quantity and type expected. This can be done by counting the pipe and by quickly checking the OD of the pipe and tool joints. That quality loop can be done using Vallourec Drilling Products certification package. In case the pipe is not of the correct type or quantity, please contact the personnel at the pipe yard immediately.

Next check that all the protectors are in place and have not been damaged or lost during transportation. In case of lost or damaged protectors, please check the connections as described below. If protectors are found to be missing or damaged then replacement ones should be sought from the supplier. If the pipe is not going to be used immediately, then check that the storage compound is in good condition in order to prevent corrosion of the connections.

It is recommended to check the Performance Data Sheet (PDS) for the product that you have at the rig site rather than wait until you are about to use it. These list the critical dimensions, performance and make-up torque values. The PDS is delivered to the customer with the pipe however it can also be downloaded from www.vamdrilling.com.

Figure 5. Inspection on arrival at rig site of new pipe
3.2 Handling of drill pipe on location

Like most pipe used at a rig site, care must be taken when handling to avoid damage. The risk of damage is reduced by handling pipe at all times with thread protectors fitted. Only remove the thread protectors on the drill floor immediately prior to making up the connections.

VAM® EXPRESS tool joints are intended for use with conventional 18° bottleneck elevators.

3.3 Application of thread compound (running dope)

Before applying the thread compound to the connections, ensure that the threads and the shoulders are clean and free of dirt or other foreign material. Drilling fluids and/or additives may affect the frictional properties of the thread compound or increase the chance of corrosion within the connection, so it is important to rinse all foreign material off the connection prior to applying thread compound.

In order to ease the application of thread compound in cold climates it may be necessary to heat the compound before application. Never add solvents to thin the thread compound.

Apply a uniform layer of thread compound, step by step:
  - on the pin threads,
  - on both pin shoulders.

It is not necessary to apply thread compound to the box connection. If thread compound is used on boxes, separate thread compound buckets should be used for box and pin to reduce mud contamination to one set of doped threads.
The thread compound should be applied evenly but sparingly so that the thread profile is still visible as shown in the following pictures:

![Figure 6. The correct application of thread compound](image)

![Figure 7. Too little thread compound](image)

![Figure 8. Too much thread compound](image)

It is important that the correct amount of thread compound is applied on connections. Vallourec Drilling Products is concerned about the use of its products on the field and their environmental impact. Please follow Vallourec Drilling Products recommendations regarding application procedure for thread compounds.

After application of thread compound the lid must be set over the bucket in order to prevent foreign material or water from entering the bucket and contaminating the compound.

3.4 Make-up & Break-out

Proper make-up of connections by engaging both external and internal shoulders with sufficient preloading is the most important factor in prevention of fatigue failure. As with any drill pipe connection, making up tool joints with rig tongs can put high bending loads in the pipe, so it is necessary to ensure that the connection is the correct height above the rotary table.

It is important to ensure good alignment between pin and box connections when making up to avoid galling of threads and other damage that can occur during stabbing and spinning in.
A stand of drill pipe can weigh more than 2,500 lbs. If poorly stabbed the entire weight of the stand could be supported by the sharp edge of just one thread. This can cause high contact stresses or damage to the threads and inadvertently remove the phosphate coating or the thread compound. The whipping action of spinning pipe can also cause high loads on threads when running in stands. As a result care must be taken during stabbing.

The tong capacity should be 140% to 150% of the recommended make-up torque to allow trouble-free break-out even after drilling operations.

Avoid banging the pin threads or pin nose surface while disengaging the connection.

Slip and tongs dies can cause damage to the tool joint, so every possible effort should be made to keep such damage to a minimum by using low marking die inserts if available.

It is recommended to place the tong dies as far from the external shoulder as possible (minimum 2") while staying above the hardbanding. For Pin side it is recommended to place the tong 1" minimum from the shoulder.

It is essential that a record be kept of the range of make up torque values used for the string. This can be done either by keeping a paper record or using a computer to record each value. Individual make-up torque values for each connection are not required.

The make-up torque values are available on the Performance Data Sheets (PDS) that are supplied with the product. These are also available by going to www.vamservices.com website and selecting the correct PDS for the drill pipe connection.

When two products presenting different grades are assembled together, the recommended make-up torque of the one with the lowest grade has to be used.

Published make-up torque values must be corrected by multiplying them by the thread compound friction factor(*)

Example:

- Published recommended make-up torque = 20 000 ft.lbs
- Thread compound friction factor = 1.12

Final make-up torque = 20 000 x 1.12 = 22 400 ft.lbs

(*) Vallourec Drilling Products declines any responsibility if thread compound do not meet supplier specifications.
A typical torque graph should show the following characteristics as shown in the diagram below:

- Slope change is due to first shoulder contact (either the external or internal shoulder),
- Slope change is due to second shoulder contact (either the internal or the external shoulder),
- Recommended Make-up Torque value of the connector.

### 3.5 Marking after Make-up

After having made-up the connection apply a mark on pin and box face to face to evaluate a possible over torque during operations.

### 3.6 Accessories

Only use VAM® EXPRESS connections on accessories made up for VAM® EXPRESS drill pipe.
3.7 **Max Break Out Torque value**

![Graph: Torque vs Turns]

The Break Out Torque value should be between 80% and 90% of the Recommended Make Up Torque value.

Monitor the break out torque value. If this torque is higher than the specified make up torque, then the connection should be inspected for mechanical damage such as box swelling, and pin stretching from over torque caused by down hole make up of the connection. In this case, use inspection program described in section 4.

*Figure 10. Max. Break out Torque value*

3.8 **Standing pipe back**

If thread protectors are used, it is not recommended to use pressed steel protectors as they may allow the weight of the stand to be supported by the primary make-up shoulder of the connection on the sharp edge of the thread protector.

When racking the pipes back in the derrick, it is important to apply oil, grease, or thread compound to the connections to avoid the risk of corrosion.
4 Inspection of used pipe

VAM® EXPRESS tool joints shall be inspected in accordance with common drill pipe inspection procedures, such as API RP7G, and take into account the points below.

People performing inspection shall be familiar with their inspection practices and have all necessary certifications prior to the inspection.

4.1 Cleaning of the connections

Prior to inspection, remove thread protectors and clean connections thoroughly by using a non-metallic brush or steam cleaner. All thread and shoulder sections shall be cleaned to allow for visual inspection and dimensional checks.

4.2 Visual inspection

The same rules apply as in section 3.1. In addition, visually inspect the internal surfaces of the tool joint as well as the pin and box threads and torque shoulders in accordance with common drill pipe inspection procedures, such as recommended practice API RP 7G.

All connections and tool joint bodies shall be free of visible cracks. Hairline cracks in the hard facing are acceptable if they do not extend into base metal. Specialized companies can check this and repair the hard banding as required.
4.2.1 Shoulder damage acceptance

The pin and box shoulders shall be free from nicks, fins, galls and other damage in accordance with recommended practice API RP 7G.

External shoulder damage (pitting or interruptions) that does not exceed 0.8 mm (1/32") in depth and crosses less than 30% of the radial width of the shoulder area is acceptable (see following sketch). If the damage exceeds these limits, re-facing is required to repair the shoulder surface, see section 5.

All rejects shall be documented on an inspection report.

![Figure 11. External shoulder damage acceptation](image)

If \[
\frac{X}{\text{width}} > 30\%
\]

the connection must be rejected.

The internal shoulder is not a seal, it is a mechanical shoulder. No raised metal or imperfections that could prevent proper make-up are permitted. This shoulder, if damaged, can be hand filed.
### 4.2.2 Control of refacing:

Drill pipe machined to VAM® EXPRESS design (see Fig.11) have benchmarks on pin and box external shoulders to check whether the connection can be refaced or not.

Pin benchmark is a groove cut inside the external shoulder that has the same depth as allowed refacing depth (1/16”). When the pin benchmark is no longer visible, it means that the connection cannot be refaced anymore.

On the box, the benchmark is a recess on the counterbore diameter of the external shoulder. This benchmark has twice the depth of allowed refacing depth. When box benchmark depth is equal to or smaller than 1/16” (1,58mm), it means that the connection cannot be refaced anymore.

Measurement of box benchmark depth is also an indicator of how much refacing was already carried out on the box part.

Measurement of box benchmark depth is also an indicator of how much refacing was already carried out on the box part.

---

**Figure 12. Pin end and Box End Benchmark**

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4.2.3 Threads

Check that the threads have not been damaged or galled during handling or make-up. Thread surfaces shall be free of pits or other imperfections that appear to exceed 1.6 mm (1/16\") in depth or 3.2mm (1/8\") in diameter, that penetrate below the thread root, or that occupy more than 40mm (1-1/2\") in length along the thread helix.

A profile thread gage should be used along the full length in two locations at least 90° apart. Both flanks should have normal contact. This means that thread profile should mesh evenly in the threads. If there is a doubt about this topic, lead measurement shall be taken.

If damage is found the connection must be re-cut by a VAM® licensee.

4.2.4 Box counter-bore

Make sure that the box counter-bore radius is free from 'rag' or other sharp edged defects caused by poor handling or stabbing. Such defects must be removed by grinding prior to reusing the connection.

4.2.5 Phosphate Coating

VAM® EXPRESS should always have a phosphate coating on both the pin and box thread and shoulder areas. If this coating is slightly worn in some areas it is acceptable, however if the coating is removed completely or if re-facing has been carried out, the connection requires re-coating with phosphate, or with a molybdenum disulfide (MoS2) repair kit (like "Molykote®" spray products).

4.3 Dimensional checks

The drawings below show the dimensions that are specific to VAM® EXPRESS connections. Ensure that all equipment has a valid calibration prior to the inspection.

![Figure 13. Main dimensions checked](image)
4.3.1 Pin & box connection length field tolerances:

The following tables list the common make-up loss (MUL) and field tolerances for VAM® Express connections:

![Table showing Make-up Loss and Field Tolerances for VAM® Express connections](image_url)

**Figure 14. Shoulder to shoulder field tolerances**
4.3.2 Box connection length

The distance between the 2 make-up shoulders shall be verified at 2 locations 90° apart. This distance shall be compared to the requirements for the connection being inspected (see Figure 14) to determine acceptance or rejection. The diagram below shows two methods of measuring this dimension.

![Diagram of box connection length inspection]

If the connection length of the box exceeds the specified dimension, then repair must be made by re-facing the external shoulder of the box connection and vice versa. Re-facing limits are the same as for repair of damaged shoulders.

4.3.3 Pin connection length

The distance between the 2 make-up shoulders shall be verified at 2 locations 90° apart. This distance shall be compared to the requirements for the connection being inspected (see Figure 14) to determine acceptance or rejection. The diagram below shows two methods of measuring this dimension.

![Diagram of pin connection length inspection]

If the connection length of the pin exceeds the specified dimension, then repair may be made by re-facing the internal shoulder of the pin connection and vice versa. Re-facing limits are the same as for repair of damaged shoulders.
4.3.4 Box and pin diameters

The maximum box counter-bore and pin nose diameters (see Figure 16) shall be found with calipers and compared to Figure 14. If the diameter is out of tolerance, the connection must be recut. Be sure to measure the box counterbore diameter and not the box benchmark diameter.

<table>
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<tr>
<th>Connection</th>
<th>Max Box Counterbore</th>
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4.3.5 Protection of the connection for further handling and storage

After inspection the connections shall have storage grease applied to avoid corrosion unless the drill pipe is run immediately.

Only protectors specially designed for VAM® EXPRESS connections may be used. These cover the whole thread section and box counter-bore. Sufficient grease should be applied to prevent the ingress of water into the connection.
5 Repair Procedures

After inspection program described above, some connections could be repaired if damages are within defined limits.

Any connections that require major repair should NOT be used.

If rethreading is necessary, it should be carried out by a VAM® Licensee using gauges to confirm that the connection is acceptable for reuse. For the location of your local VAM® Licensee please refer to the VAM® Services website at www.vamservices.com.

5.1 Corrosion / Minor damages

Minor damage to internal shoulder can be hand dressed by file or hand grinder in order to remove any protrusion interfering with mating surfaces. Do not file on external shoulders.

Any build up of corrosion should be removed using a scoring pad (like "Scotch-brite® or 400 grit emery paper).

5.2 Shoulder re-facing

This operation must be performed in a machine shop.

5.3 Phosphate coating

The connections have a phosphate layer to reduce the chance of galling during make-up. If there is phosphate missing from some areas such as after a repair or high usage, spray molybdenum disulfide (MoS₂) onto the affected area (like "Molykote® products).

This procedure could be applied after re-facing shoulders. In case of re-cut by a licensee, a complete phosphate coatings mandatory.
6 Glossary *

*(Glossary per API RP 7G)

Bevel  ► Conical surface machined 45° from the axis at the juncture of the tool joint make-up shoulder and OD,

Break-out  ► Loosening a rotary shouldered connection,

Box  ► cf. Tool joint box,

Corrosion  ► Deterioration of a material by chemical or electrochemical reaction with its environment,

Double-shouldered connection  ► Connections with torque shoulders at each end of the threaded section,

Drill pipe  ► Upset seamless steel pipe with weld-on tool joints,

Drill string  ► Drilling assembly from the swivel to the bit,

Hard banding  ► Sacrificial or wear resistance material applied to component's surface to prevent wears of the component,

Inspection  ► Process of measuring, examining, testing, gauging, or otherwise comparing the unit of product with the applicable requirements,

Lead  ► Distance the pin will advance in the box in one complete turn,

Make-up torque  ► Torque applied to tighten rotary-shouldered connection,

Pin  ► cf. Tool joint pin,

Protector  ► Cap (for pin) or plug (for boxes) placed on rotary-shouldered connections to protect the threads and shoulders while moving or during pick-up and lay-down operations,

Rotary shouldered connection  ► Two member threaded connection with sealing shoulders,

Tensile yield strength  ► Stress at which a material exhibits a specified deviation from proportionality of stress and grain,

Thread compound  ► Lubricant used on rotary-shouldered connections to ad lubricity and protect the mating surfaces from galls during make-up,

Tolerance  ► Permissible variation,

Tong space  ► Cylindrical, outside, surface of a tool joint or other threaded drill string member,

Tool joint box  ► Tool joint with internal threads,

Tool joint pin  ► Tool joint with external threads,

Tool joint  ► Threaded connection, welded the drill pipe body, for coupling lengths of drill pipe,

Torsional strength  ► Torsional load a string member can withstand without permanent deformation,

Upset  ► Forged end of a drill pipe tube used to increase wall thickness,
7 References

- API Recommended Practice 7G
  ► "Recommended Practice for Drill Stem design & Operating Limits",

- API Specification 7
  ► "Specification for Rotary Drill Stem Elements",

- API Recommended Practice 7A1
  ► "Testing of Thread Compound for Rotary Shouldered Connections"
8 Feedback Form

Vallourec Drilling Products highly encourages field users to share their experience with drill stem products. The answers collected will serve our continuous improvement plan, and help us address your issues in a timely and efficient manner.

We have included in the following page a summary sheet that we hope you will often use. Once filled in with the operational data, please send it to technicalsupport@vamdrilling.com or to your local Vallourec Drilling Products contact as listed in chapter 9.

We understand how sensitive the information you will share can be, and can ensure it will be treated as such, our ultimate goal being to keep on providing the best tools for your most challenging applications.

Thanks beforehand,

Your Vallourec Drilling Products Technical Support Team.
# PRODUCT FEEDBACK FORM

**Report By:**

**Date:**

**Contact Details:**

**RIG:**

**Operator:**

**Drilling Contractor:**

**Operations Short Summary:**

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**Rig Equipment (Make & Type):**

**Drilling Mechanics Summary:**

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**DRILL STRING**

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**Product TYPE:**

**Before Running**

**Pipe General Condition:**

**Protectors Fitted:**

**Dope Friction Factor:**

**Correct**

**NOK**

**Remarks**

**Performance Datasheet**

<table>
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<tr>
<th>Stand #</th>
<th>Make Up Torque</th>
<th>Make Up Time (min)</th>
</tr>
</thead>
</table>

**Running In Hole**

**Use of Stabbing Guide ? (Y/N):**

**Number of Times Dies were replaced:**

**Remain:**

**Correct**

**NOK**

**SEVERE**

<table>
<thead>
<tr>
<th>Stand #</th>
<th>Break Out Torque</th>
<th>Break Out Time (min)</th>
</tr>
</thead>
</table>

**Post Job**

**Tool Joint Wear**

**Tong marks**

**Thread protectors fitted ?**

**Tripping Time:**

**Number of Times Dies were replaced:**

**Remains**

<table>
<thead>
<tr>
<th>Performance Rating</th>
<th>Outstanding</th>
<th>Exceed Expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meet Expectations</td>
<td>Below Expectations</td>
<td></td>
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</tbody>
</table>

**Comments, improvement opportunities:**

---

Please return this form to techsupport@vamdrilling.com or to your Local VAM Drilling Contact.
9 Contact Vallourec Drilling Products

**HEADQUARTERS**

Vallourec Drilling Products France S.A.S.
27 avenue du Général Leclerc
92660 Boulogne-Billancourt
FRANCE
Phone : +33 1 49 09 35 61
Fax : +33 1 49 09 37 15

**MANUFACTURING FACILITIES**

<table>
<thead>
<tr>
<th>Country</th>
<th>Address</th>
<th>Phone</th>
<th>Fax</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>Vallourec Drilling Products France S.A.S. Aulnoye Plant</td>
<td>+33 3 27 69 77 29</td>
<td></td>
</tr>
<tr>
<td></td>
<td>62 rue de Leval</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>59620 Aulnoye-Aymeries</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>France</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| USA       | Vallourec Drilling Products USA Inc. Houston Plant                       | +1 713 921 0988  |                  |
|           | 6300 Navigation Blvd                                                    |                  |                  |
|           | Houston, Texas 77011                                                    |                  |                  |
|           | USA                                                                     |                  |                  |

| Holland   | Vallourec Mannesmann Oil & Gas Nederland B.V. Heerhugowaard Plant        | +31 72 574 3421  |                  |
|           | Kelvinistraat 8-16-1704 RS                                              |                  |                  |
|           | Heerhugowaard The Netherlands                                           |                  |                  |

| United Arab Emirates | Vallourec Drilling Products Middle East FZE | +971 4 883 5525 |                  |
|                     | Jebel Ali Free Zone Plant                                              |                  |                  |
|                     | P.O BOX 261108                                                         |                  |                  |
|                     | UAE                                                                     |                  |                  |

| Brasil     | Vallourec OCTG do Brasil S.A.                                          | +55 21 3873 83 00 |                  |
|           | Rua Lauro Müller, 116 - Sala 1906                                      |                  |                  |
|           | Edificio Rio Sul Center - Botafogo                                      |                  |                  |
|           | 22290-160 - Rio de Janeiro-RJ - Brazil                                 |                  |                  |
|           | Brazil                                                                  |                  |                  |

| Canada     | VAM Canada Inc.                                                        |                  |                  |
|           | 2107 - 9 Street                                                        |                  |                  |
|           | Nisku Alberta                                                          |                  |                  |
|           | Canada T9E 727                                                         |                  |                  |
|           | Phone : +1 780 955 8350                                                |                  |                  |
|           | Fax : +1 780 955 8355                                                  |                  |                  |
|           | Email : sales.drillingproducts-USA@vallourec.com                       |                  |                  |

| South America | Vallourec OCTG do Brasil S.A.                                          | +55 21 3351 72 61 |                  |
|              | Rua Lauro Müller, 116 - Sala 1906                                      |                  |                  |
|              | Edificio Rio Sul Center - Botafogo                                      |                  |                  |
|              | 22290-160 - Rio de Janeiro-RJ - Brazil                                 |                  |                  |
|              | Brazil                                                                  |                  |                  |

| Africa     | Vallourec Drilling Products France S.A.S.                              |                  |                  |
|           | 7 rue des Frères Lumières                                              |                  |                  |
|           | 59200 Cosne-sur-Loire                                                  |                  |                  |
|           | France                                                                  |                  |                  |

**REGIONAL SALES OFFICES**

| North America | Vallourec Drilling Products USA Inc.                                  |                  |                  |
|              | 6300 Navigation Blvd                                                  |                  |                  |
|              | Houston, Texas 77011                                                  |                  |                  |
|              | USA                                                                     |                  |                  |

| Canada     | VAM Canada Inc.                                                        |                  |                  |
|           | 2107 - 9 Street                                                        |                  |                  |
|           | Nisku Alberta                                                          |                  |                  |
|           | Canada T9E 727                                                         |                  |                  |
|           | Phone : +1 780 955 8350                                                |                  |                  |
|           | Fax : +1 780 955 8355                                                  |                  |                  |
|           | Email : sales.drillingproducts-USA@vallourec.com                       |                  |                  |

| South America | Vallourec Drilling Products USA Inc.                                  |                  |                  |
|              | 6300 Navigation Blvd                                                  |                  |                  |
|              | Houston, Texas 77011                                                  |                  |                  |
|              | USA                                                                     |                  |                  |

| South America | Vallourec Drilling Products USA Inc.                                  |                  |                  |
|              | 6300 Navigation Blvd                                                  |                  |                  |
|              | Houston, Texas 77011                                                  |                  |                  |
|              | USA                                                                     |                  |                  |

| Africa     | Vallourec Drilling Products France S.A.S.                              |                  |                  |
|           | 7 rue des Frères Lumières                                              |                  |                  |
|           | 59200 Cosne-sur-Loire                                                  |                  |                  |
|           | France                                                                  |                  |                  |

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North Europe

Vallourec Mannesmann Oil & Gas UK Ltd
Prospect Place, Westhill Industrial Estate
Westhill, Aberdeen AB32 6SY
UK
Phone: +44 1224 279 392
Fax: +44 1224 279 384
Contact: Chris Langrill
Email: chris.langrill@vamdrilling.com

Western Europe

Vallourec Drilling Products France S.A.S.
27 avenue du Général Leclerc
92660 Boulogne-Billancourt
France
Phone: +33 1 49 09 35 61
Fax: +33 1 49 09 37 15
Contact: Maximilien de Maisonneuve
Email: maximilien.demaisonneuve@vamdrilling.com

Middle East

VAM Dubai L.L.C
World Trade Center
Level 14, Office 14-01, PO BOX 9405
Dubai, UAE
Phone: +97 14 3320313
Fax: +97 14 3320314
Contact: Yvan Rivaux
Email: yvan.rivaux@vamdrilling.com

China

V&M (Beijing) Co. Ltd
Room 301, East Ocean Center
24A Jianguomenwai Avenue
Beijing 100004 China
Phone: +86 10 5923 3000
Fax: +86 10 5923 3063
Contact: Bono Teng
Email: bono.teng@vmtubes.com.cn

Eastern Europe

Vallourec Mannesmann Oil & Gas Germany GmbH
Theodorstrasse 90
40472 Düsseldorf
Germany
Phone: +49 211 960 2352
Fax: +49 211 960 3924
Contact: Harald Jansen
Email: harald.jansen@vamdrilling.com

Russia

Vallourec & Mannesmann RUS LLC
Office E02-305, Business – centre “Dobrynia”
4th Dobryninsky Pereulok B
Moscow, 119049
Russia
Phone: +7 495 787 49 30
Fax: +7 495 787 49 31
Contact: Alfiya Nasyrova
Email: alfiya.nasyrova@vmtubes.ru

Far East

Seamless Tubes Asia Pacific Pte. Ltd.
133 New Bridge Road,
#21-01 Chinatown Point,
Singapore 059413
Phone: +65 6733 47 78
Fax: +65 6738 91 75
Contact: Eckhard Von Hoersten
Email: eckhard.von hoersten@vamdrilling.com

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