

Field Operations Guide

FuchsRohr® AluDrill™
Aluminum Alloy Drill Pipe

GO TO
EXTREMES!

More reach. More speed. Less cost.



OTTO FUCHS
Drilling Solutions



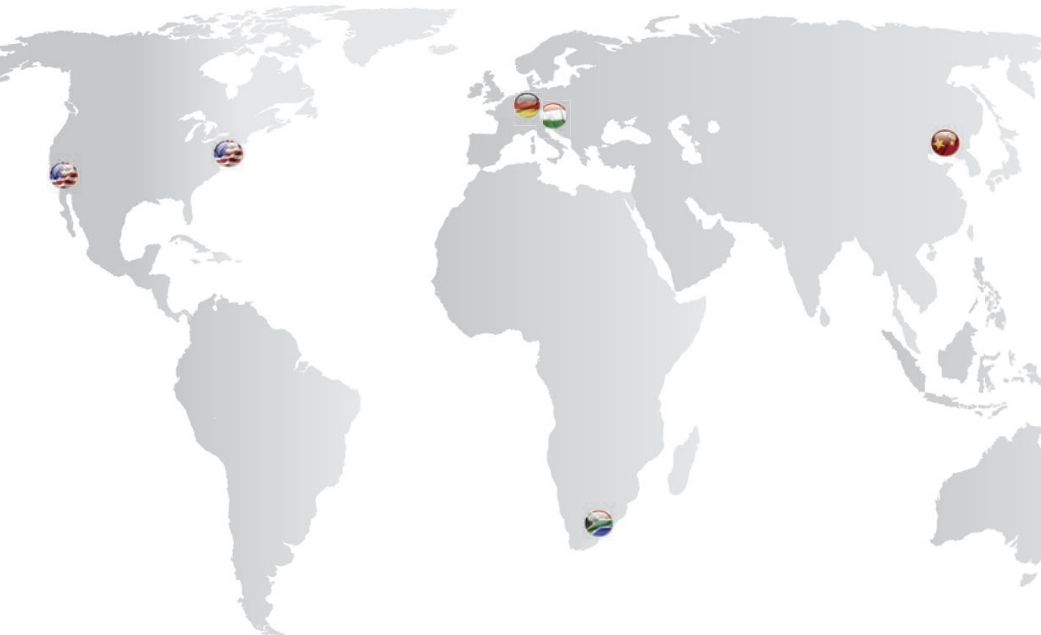
The OTTO FUCHS Group

Space flight, the global transportation of people and goods, high-tech in mechanical engineering, the striking architecture of big cities ...

... OTTO FUCHS is represented in all these with its ideas, products and solutions. Our business relationships are established all over the world, with many of our clients in the aerospace industry, the automotive and construction industries as well as the general engineering industry.

Over the years, a company that began over 100 years ago as a brass foundry has evolved into a group operating on an international basis with over 9,000 committed staff.

OTTO FUCHS KG is the nucleus and powerhouse of the group. Prudent internationalization on the one hand along with an eye on maintaining the company's competitiveness are the underlying principles of the family business in its endeavour to achieve sustainability.



OTTO FUCHS Kommanditgesellschaft
Meinerzhagen, Germany

OTTO FUCHS Drilling Solutions GmbH
Meinerzhagen, Germany

OTTO FUCHS Drilling Solutions Inc.
Delaware, USA

OTTO FUCHS Dülken GmbH & Co. KG
Dülken, Germany

OTTO FUCHS Oberflächentechnik GmbH
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FOXTEC-IKHWEZI (Pty) Ltd.
East London, South Africa

WEBER METALS, Inc.
Paramount, USA

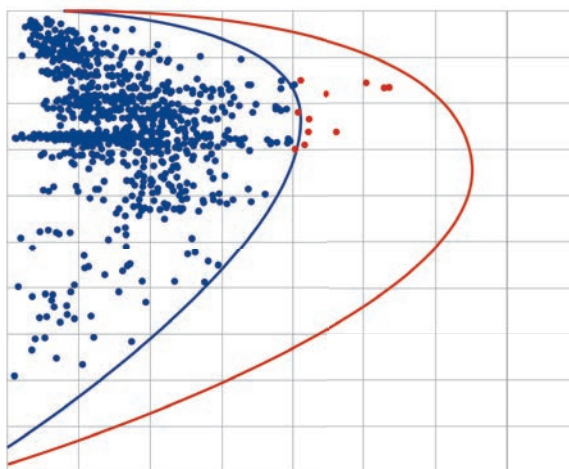
OTTO FUCHS Technology (Shenyang) Co., Ltd
Shenyang, P.R. China

TO GO TO EXTREMES, you need to look to OTTO FUCHS Drilling Solutions

OTTO FUCHS Drilling Solutions (OFDS) is an integrated product and services solutions provider to the upstream Oil & Gas industry. We are specialized in bringing high strength-to-weight metallic solutions to oil and gas operators, drilling contractors and service companies for downhole and subsea applications. Leveraging the more than 100 years of metallurgical experience of our parent company OTTO FUCHS KG it is the objective of OFDS to employ our advanced aluminum and titanium alloy products in helping our customers to improve reach, efficiency and cost reduction objectives.

A key OFDS product the aluminum alloy drill pipe - FuchsRohr® AluDrill™ - is designed to reliably extend the reach and performance of drilling operations in deepwater and horizontal drilling, 3D and extended reach drilling (ERD) applications. This advanced EN AW 2014A-T6 alloy drill pipe is available in a choice of internal and external upset designs in 3½", 4", 4½" 5", 5½", 5⅞" and 6⅝" diameters.

Expanding ERD Envelope (with high strength-to-weight Solutions)



To promote best practices and optimal results from the use of OFDS Aluminum alloy drill pipe - FuchsRohr® AluDrill™ - this manual is provided for reference. Contained are such critical topics as:

- Mechanical and physical property limits
- Pipe handling, storage and transportation procedures
- Running, drilling and completion procedures and considerations
- Safety considerations

By closely following the recommendations and procedures you will enjoy improved drilling performance and an attractive return on your investment in OTTO FUCHS Drilling Solutions best in class FuchsRohr® AluDrill™ product.

FuchsRohr® AluDrill™ - Features and Benefits

Aluminum alloy drill pipe has been proven effective through over 40 years in some of the most demanding drilling applications worldwide. FuchsRohr® AluDrill™ - takes aluminum drill pipe beyond its traditional strength-to-weight advantages adding proprietary geometries to improve handling and rig operating performance.

Aluminum drill pipe is proven to deliver a powerful and unique combination of features including:

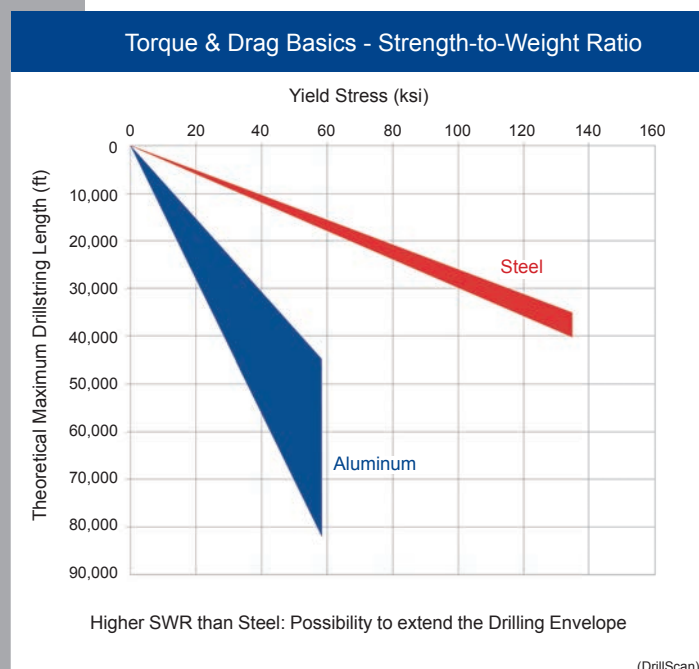
- Reduced weight
- High strength-to-weight ratio
- Reduced modulus/increased flexibility

These features can provide a wide range of benefits for drilling operations, including:

- Greater rates of penetration
- Increased drilling RPMs
- Increased drilling capacity for existing drilling equipment based on reduced pipe weight
- Reduced drilling cost made possible by the ability to use smaller, lower horsepower drilling assets

Additional advantages provided by FuchsRohr® AluDrill™ include:

- Best-in-class seamless aluminum pipe, extruded from aerospace-grade, high-strength aluminum alloys
- Proprietary pipe geometries, which strategically places the material strength where it is needed the most to improve performance, durability and reliability
- An internal upset and pipe taper to allow integration with standard drilling tools and rig operations
- Optional external upset pipe design with a consistent pipe inner diameter for improved fluid dynamics and running of tools downhole.
- Optional wear band or integral centralizer providing for reduced wear and extended pipe life. The addition of a wear band can also restrain the tendency of the pipe to buckle in the center by reducing the pipe area in the well annulus having potential for buckling.
- Certificated according to NS-1™ Level 3 - Fearnley Procter



FuchsRohr® AluDrill™ - Optimized Pipe and String Design

FuchsRohr® AluDrill™ features upset pipe geometries and a selection of tool joint options to provide maximum strength-to-weight, improved hydraulics and highest tensile/torque ratings. Optimized string performance can be achieved by placing aluminum pipe in areas where high frictional and drag forces exist while placing steel pipe where the highest torque, compression and tensile loads occur. A mixed aluminum and steel string can reduce overall string weight and torque, drag, side forces. The potential for buckling in the steel string section can also be reduced based on the optimal aluminum-steel string design.

The following FuchsRohr® AluDrill™ geometries are available as standard to meet specific drilling needs.

Note: All standard pipe designs referenced throughout this field operating guide are Type 1 with internal upset and Type 2 with internal upset plus wear band.

FuchsRohr® AluDrill™ Drilling Geometries

Type 1 - Internal upset - standard configuration



Type 2 - Internal upset with wear band



Type 3 - External upset



Type 4 - External upset with wear band



FuchsRohr® AluDrill™ HPP | Internal Upset (iu) - Type 1 Mechanical and Physical Properties

Pipe Type	3 ½	4	4 ½	5	5 ½	5 ⅝	6 ⅝
Tool Joints	NC 35	NC 40	NC 46	NC 50	5.5 FH	5.5 FH	6.625 FH
OD (in)	3.65	4.15	4.64	5.07	5.63	5.88	6.87
ID nominal (in)	2.65	3.15	3.64	4.07	4.63	4.85	5.72
ID min (in)	1.73	2.44	2.87	3.25	3.94	4.27	4.75
Wall Thickness (in)	0.50	0.50	0.50	0.50	0.50	0.51	0.58
Cross Section Area (in ²)	4.95	5.73	6.51	7.19	8.06	8.64	11.37
Weight Pipe (lb)	193.0	222.0	253.0	283.0	312.0	331.0	447.0

Pipe Body Alloy HPP K60 Rp0,2 = 60 ksi (415 N/mm ²)*							
Tensile Strength (lb)	296,900	343,600	390,300	431,100	483,500	518,500	682,100
Modulus (msi)	10.60	10.60	10.60	10.60	10.60	10.60	10.60
Torsional Strength (ft-lbf)	19,900	27,000	35,200	43,200	54,900	61,600	95,300
80% Torsional Strength (ft-lbf)	15,920	21,600	28,160	34,560	43,920	49,280	76,240
Collapse Resistance (psi)	15,800	13,700	11,800	10,400	8,900	8,700	8,100
Internal Yield Pressure (psi)	16,400	14,500	12,900	11,800	10,700	10,500	10,000

Tool Joint							
OD Tool Joint (in)	4 ½	5 ½	6	6 ⅝	7	7 ¼	8
ID Tool Joint (in)	2 ⅝ ₁₆	2 7 ₁₆	2 ¾	3 ¼	4	4	4 ¾
Box Tong Length, Lb (in)	17	17	17	17	17	17	17
PIN Tong Length, Lp (in)	14	14	14	14	14	14	14
Yield Strength (ksi)	120	120	120	120	120	120	120
Weight Tool Joint (lb)	92.00	144.00	166.00	184.00	198.00	192.00	241.00
Tensile Strength (lbf)	566,500	881,800	1,166,300	1,249,800	1,244,500	1,244,500	1,653,200
Torsional Strength (ft-lbf)	16,900	30,100	44,400	51,700	55,900	56,500	85,500
Recommended Make-Up-Torque (ft-lbf)	10,100	18,100	26,600	31,000	33,600	33,900	51,300

Assembly TJ + Pipe							
Weight Tool Joint + Pipe (lb)	285	366	419	467	510	523	688
Adjusted Weight in Air (lb/ft)	9.10	11.60	13.30	14.80	16.20	16.60	21.80
Adjusted Weight in 12 lb/gal mud (lb/ft)	5.40	7.20	8.20	9.20	9.90	10.10	13.20
Torsional Ratio TJ / Pipe	0.85	1.11	1.26	1.20	1.02	0.92	0.90
Shoulder To Shoulder Length (ft)	31.50	31.50	31.50	31.50	31.50	31.50	31.50
Open Displacement (US gal/ft)	0.31	0.37	0.42	0.47	0.52	0.54	0.72
Closed Displacement (US gal/ft)	0.57	0.75	0.93	1.11	1.36	1.47	2.00
Capacity (US gal/ft)	0.26	0.38	0.51	0.64	0.84	0.93	1.27

Properties of further types and alloys on request.

Chemical & Mechanical Properties

FuchsRohr® AluDrill™ feature heat treated EN AW 2014A T6 alloy, a high copper and silicon aluminum formula. This alloy is recognized and registered with international standards agencies such as ISO, ASTM and the Aluminum Associations. EN AW 2014A T6 originated as the alloy of choice for aerospace has been used in thousands of aerospace, defence and oil & gas applications for several decades. The key mechanical and chemical properties include:

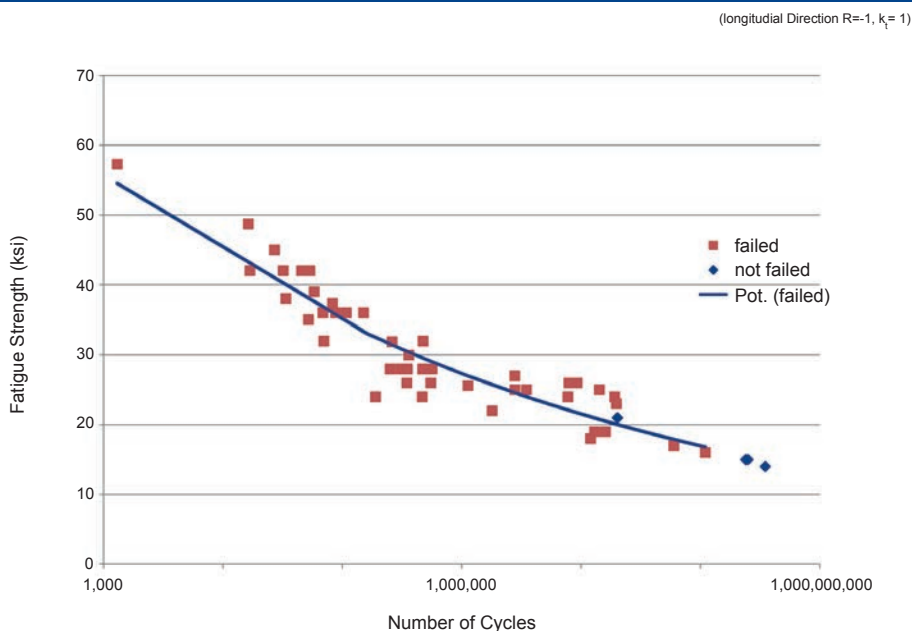
Chemical Composition Limits in Wt. % EN AW 2014A T6	
Silicon	0.50-0.9
Iron	max. 0.50
Copper	3.9-5.0
Manganese	0.40-1.2
Magnesium	0.20-0.8
Chromium	max. 0.10
Nickel	max. 0.10
Zinc	max. 0.25
Zirconium + Titanium	0.20
Others	0.15
Aluminum	remainder

Mechanical Properties - EN AW 2014A T6		
Tensile Strength	PSI	65,000
Yield Strength	PSI	60,000
Elongation (A5)	%	8
Torsional Strength	PSI	34,600
Brinell Hardness (typical)		140
Young's Modulus	PSI	10.6 x 10 ⁶
Density	lb/in ³	0.101

(Properties of longitudinal direction in main body area)

Fatigue Performance

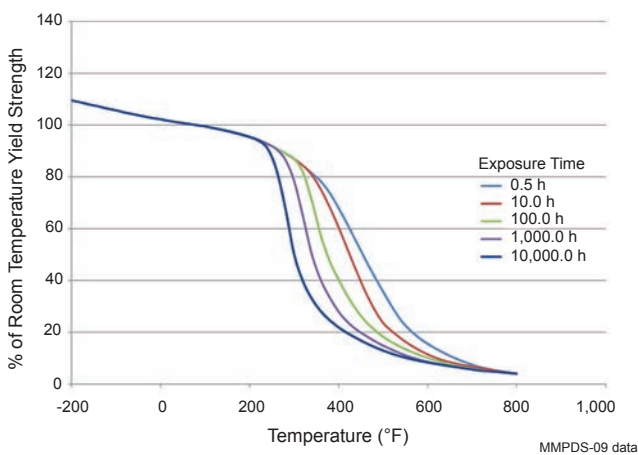
Fatigue Performance - Best-fit S/N Curve for unnotched EN AW 2014A T6 various Wrought Products



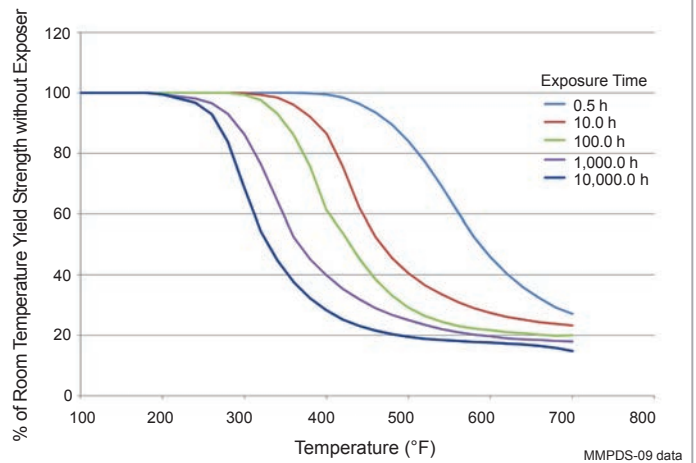
Temperature

The alloy used in aluminum drill pipe gets its strength properties from thermal practices that occur at about 340 °F. Therefore, the mechanical properties of the alloy can change with exposure to high temperatures over time. At temperatures of 240 °F and above caution must be taken when using aluminum drill pipe. Despite this, aluminum alloy drill pipe has been successfully used in wells with downhole temperatures up to 300 °F when drilling fluid circulation is maintained. Aluminum pipe used under these circumstances assumes and requires a pipe cooling effect from the drilling fluid. It must be verified that the cooling effect of the drilling fluid keeps the pipe body below 240 °F or a mechanical property reduction must be considered using OEM supplied ageing curves. When high temperature use of FuchsRohr® AluDrill™ in the 240 °F range is considered your OFDS technical representative should be consulted. OFDS does not recommend FuchsRohr® AluDrill™ be used down hole temperature exceed 300 °F

Effect of Temperature on Tensile Yield Strength



Effect of Exposure at elevated Temperature on the Room Temperature Yield Strength



Field Practices

Notice, Storage & Transportation, General Rig Site Handling

Notice:

Aluminum alloy drill pipe exhibits unique physical, chemical and mechanical properties that can differ substantially from incumbent steel alloys that are typically used in drilling applications. Precaution should be taken to read this manual fully and use the product in accordance with its design specifications and limitations.

Storage & Transportation

FuchsRohr® AluDrill™ must be stored correctly to prevent physical damage, corrosion or contamination. The key considerations are the pipe's sensitivity to acidic conditions, requiring a storage environment with a stable pH range of 7-10 and its relatively softer surface (140 Brinell as compared to 270 Brinell for typical carbon steel) requiring more careful handling.

Contact between the pipe body and steel racks or other steel pipe should be avoided. Intermediate supports (in the middle of the pipe length at no more than 10 feet intervals) should be used to prevent the pipe from bending when stored horizontally. Thread protectors should be used at all times. Closed end protectors are recommended to prevent water and dirt ingress.

The threads on the steel tool joints should be cleaned, inspected and applied with storage compound if the pipe is to be stored for more extended periods of time. See recommendations from API or the tool joint supplier for appropriate thread compounds. Caution should be taken not to mix incompatible thread compounds.

During storage it is advised to keep the aluminum pipe body clean and dry. For long-term storage it is advisable to apply a light mineral oil to the internal and external pipe body. A desiccant may also be used in storage containers to reduce humidity and moisture.

Steel end hooks should never be used with aluminum pipe. Instead double-wrapped coated steel slings or webbing slings should be used to lift the pipe in the horizontal position. In addition, fork lift tangs should be protected with wood or non-metallic covers. Where more than one joint has to be lifted strong backs, spacers or cradles should be used to minimize damage to the pipe body.

Unsupported spans should be no more than 10 feet along the pipe body.

General Rig Site Handling

The first consideration to make when handling FuchsRohr® AluDrill™ on the rig site is the pipe's upset configuration. FuchsRohr® AluDrill™ Type 1 and 2 (internal upset / internal upset with wear band) was designed to fit standard rig handling equipment, while external upset FuchsRohr® AluDrill™ Type 3 and 4 (external upset / external upset with wear band) will require small modifications to slips, dies and elevators. Please contact OFDS representative for details on handling tool modifications for FuchsRohr® AluDrill™ external upset.

When handling FuchsRohr® AluDrill™ drill pipe always avoid contact of harder or abrasive surfaces with the pipe body. Best practices include the use of soft slings, coated cables or standard lifting collars, caps or elevators. In addition, protected fork truck prongs should always be used for lifting.

Other key handling points include:

- Avoid stacking steel drill pipe on top of FuchsRohr® AluDrill™.
- Avoid impacts to FuchsRohr® AluDrill™ with harder surfaces.
- Use bump rings to maintain horizontal separation of FuchsRohr® AluDrill™.
- If possible, support the FuchsRohr® AluDrill™ in the middle of each joint to prevent sagging. Spans of aluminum pipe should be supported at 10 feet intervals.
- Use wooden or composite dunnage to support and separate each layer of FuchsRohr® AluDrill™.
- Remove protectors, clean off storage compound and inspect all tool joints.
- Apply running compound and re-fit clean thread protectors.

Follow all recommendations from API or the tool joint supplier for your FuchsRohr® AluDrill™.

Field Practices

Horizontal and Vertical Pipe Handling

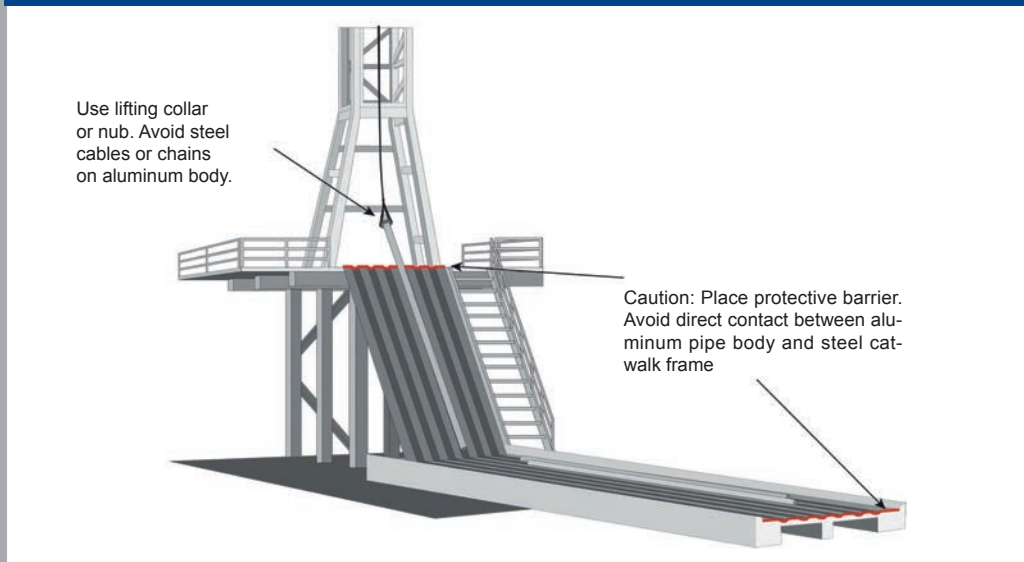
Horizontal Pipe Handling

When handling FuchsRohr® AluDrill™ consideration should be given to its lower modulus ($\frac{1}{3}$ of steel pipe) and its resulting flexibility. Some horizontal pipe handling management systems may only grip the pipe over a short length which in the case of aluminum drill pipe may cause excessive bending. Any bent or bowed pipe should be taken out of service for further inspection and repair. Contact your OFDS representative for repair procedures.

Other key handling points include:

- **Horizontal pipe handling management systems with aggressive steel toothed jaws should not be used on the body section of FuchsRohr® AluDrill™.**
- Conventional single joint elevators (SJE's), lifting elevators or lifting caps should be used wherever possible.
- When working with a conventional pipe deck, ramp and v-door setup avoid impacts between the FuchsRohr® AluDrill™ body and steel ramps, stops, edges etc.
- Always provide a protective barrier between the softer aluminum surface and any harder or abrasive surfaces such as steel or concrete.

Pipe Horizontal Management System



Vertical Pipe Handling

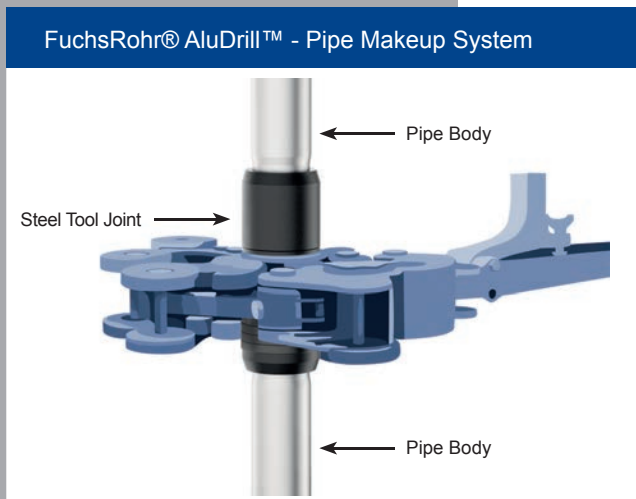
FuchsRohr® AluDrill™ Type 1 and 2 (internal upset / internal upset with wear band) include standard 18° elevator shoulder and can be handled with standard elevators, slips, lifting elevators, etc. For additional security one should always use grit-face low marking die inserts with any FuchsRohr® AluDrill™. Note that Type 3 and 4 (external upset / external upset with wear band) will require modified slips and elevators due to the larger outside diameter near the tool joint.

Other key handling points include.

- Vertical pipe handling management systems with aggressive steel toothed jaws should not be used on the body section of FuchsRohr® AluDrill™.
- Vertical pipe handling management systems that support the joint or stand by using the box shoulder and lower arm to grip and steady the joint are acceptable.
- FuchsRohr® AluDrill™ should not be racked back in mixed combinations of steel joints above FuchsRohr® AluDrill™.
- Care should be taken when racking back stands of FuchsRohr® AluDrill™ into fingerboard systems to avoid damaging the body of the pipe.
- Standard pin end thread protectors and procedures should be used.

Field Practices

Makeup Systems, Handling Tools, Elevators, Slips/Spiders



Makeup systems

Makeup and breakout torque should only be applied to the steel tool joint and never to the body of the aluminum pipe. Spinners may be used on the FuchsRohr® AluDrill™ body if they have aluminum, composite or other non-marking rollers. Caution should be taken with conventional steel spinners. These spinners should only be used if spin up on the tool joint is possible.

If rig tongs and cathead or sand lines are used, bending forces on the FuchsRohr® AluDrill™ set in slips or spider shoulder be kept to a minimum. This can be accomplished by ensuring that the cathead and backup line are not pulling in the same direction and keeping the stickup length as short as possible.

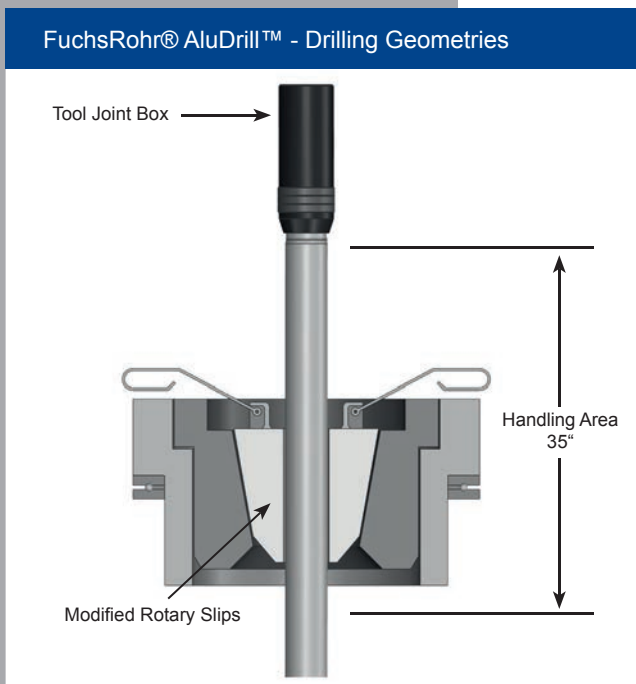
Never use steel chains on the aluminum pipe body.

Handling Tools

FuchsRohr® AluDrill™ Type 1 and Type 2 (internal upset / internal upset with wear band) have a parallel outer surface in the area used to position the elevator and the spider/slips. These pipes also feature a heavy wall section below the pin and above the box. This heavy wall section extends for a set distance (length of internal upset) followed by a transition zone where the inner diameter increases to the nominal size. By contrast, FuchsRohr® AluDrill™ Type 3 and Type 4 (external upset / external upset with wear band) will require small modifications to the slips, dies and elevators. Please contact OFDS representative for details on handling tool modifications.

Elevators

Standard 18° shoulder type elevators should be used. Ideally, the steel pin end connections on the FuchsRohr® AluDrill™ will have the same profile (outside diameter of FuchsRohr® AluDrill™ upset) as the rest of the string and no changes will be required. However, the outer diameter of the pin-end connectors may be smaller than the rest of the string so the load capacity of the elevator being used should be checked using the elevator manufacturer's recommendations. If the profiles are not compatible considerable time savings can be achieved by using elevators with replaceable inserts.



Slips/Spiders

Always utilize a shoulder type elevator. Slip-type elevators should **not** be used. Handslips, power slips (PS) or flush mounted spiders (FMS) will have to be used at the rotary table. These tools should be fitted with minimal marking (grit faced), non-ferrous dies. It is likely that these tools will not be compatible with the tools used for the steel drill pipe joints and a changeover will be required. If the FuchsRohr® AluDrill™ is being run at the bottom of a longer steel string and the vertical loads seen by the FuchsRohr® AluDrill™ are low (less than 100 t) time savings can be achieved by using a small false rotary and spider positioned above the master bushing, PS or FMS.

If higher loads are seen by the FuchsRohr® AluDrill™ the external collapse rating of the FuchsRohr® AluDrill™ in the slip setting area should be checked. When setting the pipe in the slips, caution should be taken to set the slips in the tapered handling area where the heavier wall improved the pipe strength and resistance to damage and collapse.

Care should be taken to ensure that the surface of the dies is kept free of impact material e. g. mud, cuttings.

Field Practices

Drilling Fluids

Drilling Fluids

The reaction of FuchsRohr® AluDrill™ to drilling fluids will be different from conventional steel drill pipe. PH, salt content and levels of abrasion should be carefully considered. Oil-based muds will enhance the friction, torque and drag reduction characteristics of Fuchs-Rohr® AluDrill™. In addition, oil-based muds will reduce the corrosion and wear of the aluminum pipe body and extend the product life.

Other considerations include:

- PH levels should be kept between 7 and 10 for oil and water and salt-based muds.
- Brine/salt content should be kept below 180,000 ppm.
- PH and brine levels should be checked at regular intervals.

It is normal for the EN AW 2014A (HPP K60) alloy to develop some corrosion with field use. The corrosion will appear as a white powder or shallow pitting. Typically, the impact of this corrosion is only relevant in terms of the wall reduction over time and this should be monitored and appropriate downgrades taken during regular inspections.

FuchsRohr® AluDrill™ features a smooth transition between the pipe body and the steel connections. However, circulating at high flow rates (during clean-up, etc.) with high abrasive solid content (sand, cuttings, wellbore material) should be minimized or avoided.

Conventional corrosion inhibitors may react differently with FuchsRohr® AluDrill™. For more details and also prior to running special fluids: completion fluids, packer fluids, gel pills etc. please contact an OFDS representative.



Field Practices

Blowout Preventers, Completions, Workover, Intervention Operations

Blowout Preventers (BOPs)

When selecting BOPs configurations the varying outer diameter of the steel drill pipe, the FuchsRohr® AluDrill™ tool joints and pipe body should be considered. It is recommended to use a varia-bore BOP to allow for successful closure on the variable diameters.

In the case of shear rams, it is preferred to use a cutting style ram rather than a fold-over type. Given the lower elongation of the aluminum pipe body, the FuchsRohr® AluDrill™ will tend to fracture rather than shear during the fold over process. The aluminum will cut much faster and at much lower forces than the steel pipe when a shear ram is employed.



Completion, Workover and Intervention Operations

Coated FuchsRohr® AluDrill™ should be employed anytime cementing operations are considered. Conventional well construction cement has pH in the range of 13 which will excessively corrode the aluminum pipe body and reduce life. The additional use of a cementing stinger will separate the cement from the external pipe body and reduce or eliminate the potential for exposure and resulting corrosion. Other considerations include:

- Acids should **never** be used with FuchsRohr® AluDrill™.
- Wireline operations should always use coated wire to avoid damage to the inner diameter of the FuchsRohr® AluDrill™.
- Tool profiles and sizes should take into account the internal upset in the FuchsRohr® AluDrill™ as the internal diameter will be different to standard steel pipe, so proper consideration should be made for any tool to be run downhole through the pipe inner diameter.
- Note: internal burst and external collapse pressure ratings are published on the data sheets for each FuchsRohr® AluDrill™ product.

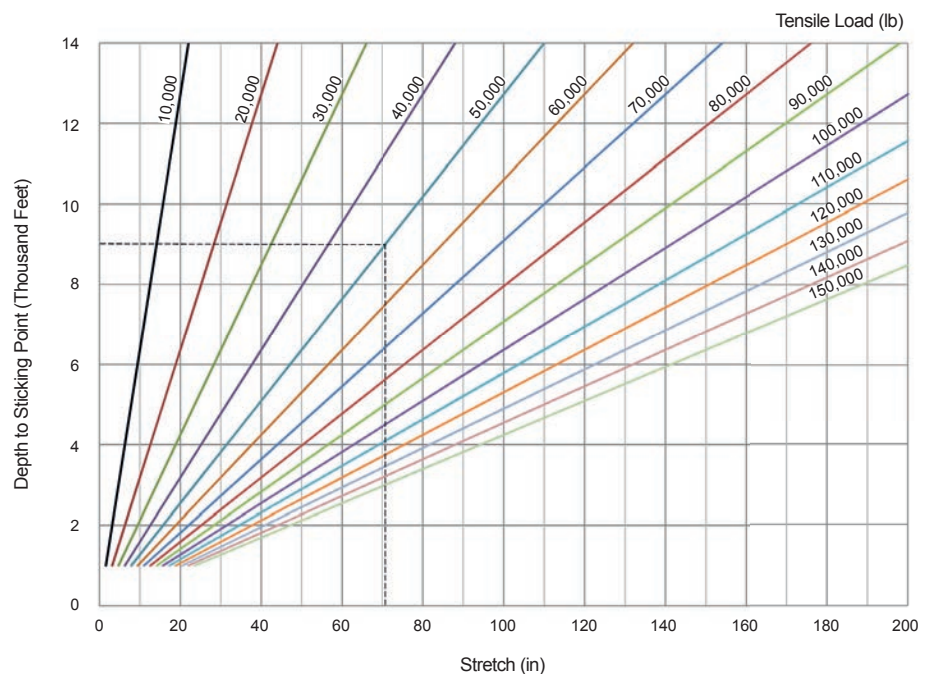
Field Practices Fishing

Fishing

Depending on where the string has parted fishing FuchsRohr® AluDrill™ has several significant differences when compared to fishing steel drill pipe:

- The outer and inner diameter of the FuchsRohr® AluDrill™ can differ from that of standard steel pipe. Considerations should be taken when selecting the proper overshot or tap.
- FuchsRohr® AluDrill™ will have slightly lower yield and hardness values than steel drill pipe. Overshots, grapples and spears which rely on the shear loads imparted by teeth, spikes etc. will penetrate further into the pipe. This additional penetration should offset any reduction in pulling capacity due to the reduced yield values.
- The body of the FuchsRohr® AluDrill™ is non-magnetic. Correspondingly, stuck point indicators must be non-magnetic in nature.
- FuchsRohr® AluDrill™ has higher stretch values than the equivalent steel drill pipe. Check the appropriate data sheets for actual values.
- The stretch and spring back energy of aluminum drill pipe is greater than steel.
- On a heavy pull safety precautions should be exercised to prevent personal injury.

Stretch Curves for Determining Free Length of 5" FuchsRohr® AluDrill™ incl. Wearband and Tool Joints, Range 2



Example: A pull of 50,000 lb in excess of total weight of drill string resulting in 71 inch stretch indicates pipe stuck at 9,000 ft.
Data are taken from a real test.

Care should be taken that the tensile yield of the aluminum pipe is not exceeded. Measure mid-length pipe diameter after the fish so that any permanent stretch can be detected.

If circulation is lost, or if the fish is without circulation when temperatures exceed 250 °F, high torsional and/or tensile load should be avoided until pipe temperature can be reduced.

Post Job Inspection & Repair

FuchsRohr® AluDrill™ can be successfully field inspected using conventional visual and ultrasonic techniques. Inspection procedures are similar to those used for steel pipe. One such exception is that magnetic tools and techniques cannot be used on the aluminum pipe body. A second exception is based on the fact that FuchsRohr® AluDrill™ employs a thermal interference fit rather than a weld, to join dissimilar metals. In this case the dissimilar metals are steel tool joints joined to an aluminum body. A special dimension check as described below should be made to assess the integrity of this service connection.

Inspection of FuchsRohr® AluDrill™ is broken into four areas. A general description of the inspection techniques for each follows.

Tool Joints

FuchsRohr® AluDrill™ uses conventional steel tool joints. Inspection and repair procedures can be engaged according API or manufacturer standards. Dimensional and ultrasonic measurements should be made for wear four positions 90° apart with and appropriate downgrade noted. Also, conventional inspection techniques should be used for cracks to the tool joint or hard banding.

Aluminum Pipe Body

Inspection is very similar to steel drill pipe. Visual inspection should be made before and after each drilling use for scratches, gouges, bowing or other visual damage. Scratches or gouges should be measured for wall reduction and appropriate downgrade takes. Scratches and gouges should be buffed or lightly sanded to remove rough edges and stress risers. Visibly bent or bowed pipe should be retired from service. However, bowed pipe can be repaired by using spin-straightening techniques. Please contact OFDS representative for approved straightening techniques.

Dimensional checks of pipe body should be made to assess all critical dimensions such as length, outside diameter and wall thickness. Conventional pi tapes, tape measures and ultrasonic techniques can be used to assess the aluminum body dimensions, wall thickness and to detect cracks. Appropriate downgrade of pipes or removal from service should be taken based on wall reduction or crack detection. Please contact us for special software of life-cycle analysis.

Service Connection

To assess the integrity of the connection between pin and box tool joint a punch mark is placed on each 18° shoulder. The alignment can be checked by using a magnetic protractor placed on each of the tool joints. If more than 5° of displacement is detected between the tool joints, the pipe should be taken from service for inspection by an OFDS representative.

If there is an appearance of any damage or unusual markings near the service connection or displacement of the tool joint service connection is detected, a hydrostatic pressure test of 80 % of pipe internal yield pressure (or maximum 7,000 psi) should be conducted to assess leaks in the tool joint connection. This test should detect no leaks. However, if leaks are detected the pipe should be removed from service.

Coatings

If the FuchsRohr® AluDrill™ is coated it should be inspected and repaired according to the recommendations and procedures of the coating manufacturer. Typically, this process will require periodic use of borescope to assess the condition of the coating on the inside diameter of the pipe. If cracks or peeling are detected, the pipe should be removed from service and the coating replaced. Coatings must be applied below 250 °F.

Frequency of inspection

A complete and thorough visual inspection should be made before and after each use. It is recommended that a full inspection including dimensional, ultrasonic, borescope and hydrostatic pressure measurements has to be made after every 15,000 ft of drilling distance.

For detailed inspection procedures please contact a OFDS representative.

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