ARMOR TOOLS INTL

2019
DOWN HOLE TOOLS
CATALOGUE

PROTECTING YOUR ASSETS

Down Hole Tools Catalogue

Snubbing • Completions • Drilling

1-855-900-2442

www.armortools.ca

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Armor Rupture Disc®

Patent No. CA2863603 C

Protecting Your "Assets"

The Patented Rupture Disc® is exclusive to Armor Tools Intl. Inc.

Our Rupture Disc® is designed and engineered to answer the industries need for a full bore ID pressure control barrier. The design eliminates the inconsistent "shark tooth" result seen in other products. This "shark tooth" protrusion can cause damage to swab cups, plug profile packing and more.

One of the many important features designed into the Rupture Disc® is a controlled Rupture pattern that leaves miniscule debris in the well bore unlike other products that leave larger inconsistent chunks of ceramic.

Features & Benefits

- ✓ **Full Bore ID separation groove**
- ✓ **Rupture Pattern**
- ✓ **Available in 5k, 10k, & 15K**
- ✓ **A lower (pressure) and more consistent Rupturing differential**
- ✓ **Ideal in Horizontal applications**
- ✓ **Hydrocarbon compatible**
- ✓ **Sour service Compliant**
- ✓ **Disc temperature rating of 1600c**
- ✓ **Superior up to dateproprietary ceramic technology creates a durable and predictable pressure control device**
- ✓ **Controlled debris sizes allows the Rupture Disc® to be used in wells with downhole pumps and screens.**
- ✓ **ISO Compliant**

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Armor Single Barrier Rupture Disc Tool®

Protecting Your "Assets"

The Armor Single Barrier Rupture Disc Tool® is engineered and enhanced to create a pressurebarrier in a live well between the well bore and the completion tubing strings (BHA).

This Armor Single BarrierRupture DiscTool® can be installed strategically in multiple locations in the tool string during live well control operations (Snubbing).

The Armor Single Barrier Rupture Disc Tool® can also work in conjunction with other downhole toolsduring live well workovers and completions. Examples: TCP Assemblies, Fishing assemblies, Packers, etc.

Once the tubing string is at your required depth, the Armor Rupture Disc® can be removed by simply overcoming differential pressure within the tubing string.

(See data sheet for Rupturing differentials)

Features & Benefits

- ✓ **Designed Specifically for live well control (Snubbing)**
- ✓ **Available in 5k, 10k & 15K pressure ratings**
- ✓ **All Rupture Disc Tools® are manufactured with L-80 material (Sour Service Rated)**
- ✓ **Anti-Rotation set screws prevent threads from disengaging during downhole tool retrieval (packers, bridge plugs).**
- ✓ **New Body Torque through capability (See spec sheet for allowed torque)**
- ✓ **Patented Rupture Disc® with Bore ID separation groove &shatter pattern**
- ✓ **New and Improved Lo-Hi pressure seal engaging design (Patent Pending)**
- ✓ **All Single Barrier Rupture Disc Tools® are pressure tested, charted and serialized for full traceability**
- ✓ **Special Clearance design available while maintaining Engineered ratings**
- ✓ **Eliminates wire line operations while running in highly deviated wells**
- ✓ **Eliminates accidental plug release, increasing safety during well control operations**
- ✓ **Eliminates excess wire line operations due to miss runs, debris (sand) etc.**
- ✓ **Approved for single & dual barrier applications (Snubbing IRP 15 Plug Matrix)**
- ✓ **Customers can special order any size, material, threads, coatings&special hardenings**
- ✓ **ISO Compliant**

Recommended Handling & Running Procedures

1. **Insure the Rupture Disc Tool is transported from the Manufacture to the End-User location in "Safe Trip Package".**
2. **Equalize the outer side of the BHA in a slow consistent manner**
3. **Apply fluid equivalent to ½ joint above the Rupture Disc®. Fluid cushion can protect the Rupture Disc® from objects that may accidently drop down the inner bore**

NOT FOLLOWING THE OUT LINE RECOMMENDATIONS COULD RESULT IN PRODUCT FAILURE
Rev-18 Nov 2018

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ARMOR TOOLS INTL

Armor Single Barrier Rupture Disc Tool®

TOOL DESCRIPTION inch (mm)	TOOL O.D. Standard Clearance inch (mm)	TOOL O.D. Special Clearance inch (mm)	TOOL I.D. inch (mm)	CONCAVE SIDE psi (mpa) Rupturing differential	CONVEX SIDE psi (mpa) Disc Rating
2-3/8 (60.3)*	3.063 (77.8)	2.90 (73.66)	1.905 (48.4)	500 (3447)	5,000 (34.5)*
2-3/8 (60.3)*	3.063 (77.8)	2.90 (73.66)	1.905 (48.4)	750 (5171)	10,000 (68.9)*
2-3/8 (60.3)**	3.063 (77.8)	2.90 (73.66)	1.905 (48.4)	1,000 (6894)	15,000 (103.4)**
2-7/8 (73.0)*	3.66 (92.96)	3.46 (87.88)	2.45 (62.2)	500 (3447)	5,000 (34.5)*
2-7/8 (73.0)*	3.66 (92.96)	3.46 (87.88)	2.45 (62.2)	750 (5171)	10,000 (68.9)*
2-7/8 (73.0)**	3.66 (92.96)	3.46 (87.88)	2.45 (62.2)	1,000 (6894)	15,000 (103.4)**
3-1/2 (88.9)*	4.475 (113.66)	4.18 (106.2)	3.00 (76.2)	500 (3447)	5,000 (34.5)*
3-1/2 (88.9)*	4.475 (113.66)	4.18 (106.2)	3.00 (76.2)	750 (5171)	10,000 (68.9)*
3-1/2 (88.9)**	4.475 (113.66)	4.18 (106.2)	3.00 (76.2)	1,000 (6894)	15,000 (103.4)**

***Denotes L 80 (NACE – Sour Service) Material and ** Denotes P110 (Non-Sour Service)**
Material required to meet Engineered Tool Burst Rating

Single Barrier Rupture Disc Tool ® Standard Body Specifications

DESCRIPTION	2-3/8 (60.3mm)		2-7/8 (73.0mm)		3-1/2 (88.9mm)	
Maximum OD	3.063 in	77.8 mm	3.66 in	93.6 mm	4.475 in	113.66 mm
Maximum ID	1.905 in	48.39 mm	2.45 in	62.23 mm	3.00 in	76.20 mm
Overall Length	11.465 in	290.98 mm	11.492 in	291.89 mm	12.932 in	328.47 mm
Pressure Options	5,000 psi (34.45 Mpa)*		10,000 psi (68.9 Mpa)*		15,000psi (103.35 Mpa)**	
Min & Max Temp.	-40 c (-40 F) 160c (320 F) with Teflon & HNBR (Sour Service) seals. Temperature rated seals above 160c (320 F) can be supplied upon request					
Tensile Strength*	141 200 lbs	62.808 daN	170 000 lbs	75 650 daN	239 000lbs	106.355daN
Tensile Strength**	194 100 lbs	86.340 daN	234 000 lbs	104 130 daN	329 000lbs	146.405daN
Internal Yield Pressure*	13 900 psi	95.84 Mpa	14 500 psi	99.97 Mpa	15 200 psi	104.80 Mpa
Internal Yield Pressure**	19 200 psi	132.38 Mpa	19 900 psi	137.20 Mpa	20 900 psi	144.10 Mpa
Collapse Pressure*	12 700psi	87.56 Mpa	13 200 psi	91.01 Mpa	11 400 psi	78.60 Mpa
Collapse Pressure**	17 500 psi	120.66 Mpa	18 100 psi	124.79 Mpa	15 200 psi	104.80 Mpa
Torque Through Body Specs-L80	Must not exceed 2593 ft-lbs		Must not exceed 4606 ft-lbs		Must not exceed 7715 ft-lbs	
Connection BxP	2-3/8 in (60.3mm) EUE		2-7/8 in (73mm) EUE		3-1/2 in (88.9mm) EUE	
Material/Metal*	L80 Nace*	L80 Nace*	L80 Nace*	L80 Nace*	L80 Nace*	L80 Nace*
Material/Metal**	P110**	P110**	P110**	P110**	P110**	P110**

Single Barrier Rupture Disc Tool® Special Clearance (SC) Specifications

Description	SC 2-3/8 (60.3mm)		SC 2-7/8 (73.0mm)		SC 3-1/2 (88.9mm)	
Maximum OD	2.90in	73.66 mm	3.46 in	87.88 mm	4.187 in	106.35 mm
Maximum ID	1.905in	48.39 mm	2.45 in	62.23 mm	3.00 in	76.20 mm
Overall Length	11.465in	290.98 mm	11.492 in	328.89 in	12.932 in	328.47 mm
Pressure Options	5,000 psi (34.45 Mpa)*		10,000 psi (68.9 Mpa)*		15,000psi (103.35 Mpa)**	
Min & Max Temp.	-40 c (-40 F) 160 C (320 F) with Teflon & HNBR (Sour Service) seals. Temperature rated seals above 160c (320 F) can be supplied upon request					
Tensile Strength*	81 200 lbs	36.120 daN	122 000 lbs	54.290 daN	199 000 lbs	88.599 daN
Tensile Strength**	111 700 lbs	49.687 daN	168 000 lbs	74.760 daN	273 700 lbs	121.796 daN
Internal Yield Pressure*	13 900 psi	95.84 Mpa	14 500 psi	99.97 Mpa	15 200 psi	104.80 Mpa
Internal Yield Pressure**	19 200 psi	132.38 Mpa	19 900 psi	137.20 Mpa	20 900 psi	144.10 Mpa
Collapse Pressure*	8 600 psi	59.29 Mpa	9 200 psi	63.431 daN	10 600 psi	73.08 Mpa
Collapse Pressure**	10 700 psi	73.77 Mpa	11 600 psi	79.979 daN	14 600 psi	100.66 Mpa
Torque Through Body Specs-L80	Must not exceed 1367 ft-lbs		Must not exceed 2759 ft-lbs		Must not exceed 3372 ft-lbs	
Connection BxP	SC2-3/8 in (60.3mm) EUE		SC 2-7/8 in (73 mm) EUE		3-1/2 in (88.9mm) EUE	
Material/Metal*	L80 NACE*	L80 NACE*	L80 NACE*	L80 NACE*	L80 NACE*	L80 NACE*
Material/Metal**	P110**	P110**	P110**	P110**	P110**	P110**

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45 – 50 – 55 HD Series

Armor Single Barrier Rupture Disc Tool®

Protecting Your "Assets"

The Armor Single Barrier Rupture Disc Tool® is engineered and enhanced to create a pressure barrier in a live well between the well bore and the completion casing strings.

This Armor Single Barrier Rupture Disc Tool® can be installed strategically in multiple locations in the tool string during live well control operations (Snubbing).

The Armor Single Barrier Rupture Disc Tool® can also work in conjunction with other downhole tools during live well workovers and completions. Examples: Packers, etc.

Once the casing string is at your required depth, the Armor Rupture Disc® can be removed by simply overcoming differential pressure within the tubing string.

(See data sheet for Rupturing differentials)

Features & Benefits

- ✓ **Designed Specifically for live well control (Snubbing)**
- ✓ **Available in 5k, 10k & 15K pressure ratings**
- ✓ **All Rupture Disc Tools® are manufactured with P110 material**
- ✓ **Anti-Rotation set screws prevent threads from disengaging**
- ✓ **New Body Torque through capability (See spec sheet for allowed torque)**
- ✓ **Patented Rupture Disc® with Bore ID separation groove &shatter pattern**
- ✓ **New and Improved Lo-Hi pressure seal engaging design (Patent Pending)**
- ✓ **All Single Barrier Rupture Disc Tools® are pressure tested, charted and serialized for full traceability**
- ✓ **Special Clearance design available while maintaining Engineered ratings**
- ✓ **Eliminates wire line operations while running in highly deviated wells**
- ✓ **Eliminates accidental plug release, increasing safety during well control operations**
- ✓ **Approved for single & dual barrier applications (Snubbing IRP 15 Plug Matrix)**
- ✓ **Customers can special order any size, material, threads, coatings & special hardenings**
- ✓ **ISO Compliant**

Recommended Handling & Running Procedures

1. **Insure the Rupture Disc Tool is transported from the Manufacture to the End-User location in "Safe Trip Package".**
2. **Equalize the outer side of the BHA in a slow consistent manner**
3. **Apply fluid equivalent to ½ joint above the Rupture Disc®. Fluid cushion can protect the Rupture Disc® from objects that may accidently drop down the inner bore**

NOT FOLLOWING THE OUT LINED RECOMMENDATINS COULD RESULT IN PRODUCT FAILURE

45 – 50 – 55 HD Series

Armor Single Barrier Rupture Disc Tool®

ARMOR RUPTURE DISC TOOL – AVAILABLE SIZES

TOOL DESCRIPTION inch (mm)	Tool Casing Weight Lb-ft / kg-m	TOOL Material (available)	CONCAVE SIDE psi (mpa) Rupturing differential	CONVEX SIDE psi (mpa) Disc Rating
4-1/2 (114.3)	11.6-15.10/17.26-22.47	L80 / P110	500 (3447)	5 000 (34.5)
4-1/2 (114.3)	11.6-15.10/17.26-22.47	L80 / P110	750 (5171)	10 000 (68.9)
4-1/2 (114.3)	11.6-15.10/17.26-22.47	L80 / P110	1 000 (6894)	15 000 (103.4)
5 (127.0mm)	13.0-18.0 / 18.0-26.80	L80 / P110	500 (3447)	5 000 (34.5)
5 (127.0mm)	13.0-18.0 / 18.0-26.80	L80 / P110	750 (5171)	10 000 (68.9)
5 (127.0mm)	13.0-18.0 / 18.0-26.80	L80 / P110	1 000 (6894)	15 000 (103.4)
5-1/2 (139.7)	17.0-23.0 / 25.3-34.23	L80 / P110	500 (3447)	5 000 (34.5)
5-1/2 (139.7)	17.0-23.0 / 25.3-34.23	L80 / P110	750 (5171)	10 000 (68.9)
5-1/2 (139.7)	17.0-23.0 / 25.3-34.23	L80 / P110	1 000 (6894)	15 000 (103.4)
Custom Casing sizes / weight available **Custom Rupture pressure rating available with lead time**				

23 – 27 HD Series

Armor Combo Rupture Disc Tool®

Protecting Your "Assets"

The Armor Combo Rupture Disc Tool® was invented as a safe, efficient and economical way to combine both a Rupture Disc® and a specific profile together as one tool. This revolutionary design is accepted and utilized by the Oil and Gas Industry in the Canadian Western Basin for years and is promoted by the snubbing industry.

This Armor Combo also works in conjunction with the Armor Single Barrier Rupture Disc Tool® to become a dual barrier system, creating the process safety environment we all strive for in our industry.

Once the tubing string is at your required depth, the Armor Rupture Disc® can be removed by simply overcoming differential pressure within the tubing string.
(See data sheet for Rupturing differential)

Patent No.

CA 2,762,730 - US 9,540,904

Features & Benefits

- ✓ **Designed specifically for the live well control industry (Snubbing)**
- ✓ **Available in 5k, 10k & 15K pressure ratings**
- ✓ **Available (stocked items) in (1.87 AOXN / AORN), (1.87 AOX / AOR) & (2.31 AOX & 2.31 AOXN)(A) = Armor (O) = Otis®**
- ✓ **All Rupture Disc Tools® are manufactures using L-80 MTRL (Sour Service Rated)**
- ✓ **Anti-Rotation set screws prevent threads from disengaging during downhole tool retrieval (packers/bridge plugs)**
- ✓ **New Body Torque through capability (See spec sheet for maximum allowed torque)**
- ✓ **Patented Rupture Disc® with Bore ID separation groove & shatter pattern**
- ✓ **New and improved Lo-Hi pressure seal engaging design (Patent Pending)**
- ✓ **Special Clearance design available while maintaining Engineered ratings**
- ✓ **All Combo Rupture Discs Tools® are pressure tested, charted and serialized for full traceability**
- ✓ **With Snubbing's new fully guided systems the Combo Rupture Disc Tool® system reduces BHA length, thus simplifying snubbing operations.**
- ✓ **Eliminates wireline operations while running in highly deviated wells**
- ✓ **Eliminates accidental plug release, increasing safety during well control operations**
- ✓ **Eliminates excess wireline operations due to miss runs, debris (sand) etc.**
- ✓ **Approved for single and dual barrier applications (Snubbing IRP 15 Plug Matrix)**
- ✓ **Customers can special order any size, profile, material, threads, coatings or special hardenings**
- ✓ **Drifted and Lockset tested with calibrated Genuine Otis® tools**
- ✓ **Comparable Otis® Profiles** **Otis® is a registered trademark of Halliburton Energy Services**
- ✓ **ISO Compliant**

Recommended Handling &Running Procedures:

1. **Insure the Rupture Disc Tool is transported from the Manufacture to the End User location in "Safe Trip Package"**
2. **Equalize the outer side of the BHA in a slow consistent manner.**
3. **Apply fluid equivalent to ½ joint above the Rupture Disc®. Fluid cushion can protect the Rupture Disc® from objects that may accidently drop down the inner bore.**

NOT FOLLOWING THE OUT LINED RECOMMENDATIONS COULD RESULT IN PRODUCT FAILURE
Rev-22Nov - 2018

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23 – 27 HD Series

Armor Combo Rupture Disc Tool®

TOOL DESCRIPTION inch (mm)	TOOL O.D. Standard Clearance inch (mm)	TOOL O.D. Special Clearance inch (mm)	TOOL I.D. inch (mm)	CONCAVE SIDE psi (mpa) Rupturing differential	CONVEX SIDE psi (mpa) Disc Rating
2-3/8 (60.3)*	3.063 (77.8)	2.90 (73.66)	1.905 (48.4)	500 (3447)	5,000 (34.5)*
2-3/8 (60.3)*	3.063 (77.8)	2.90 (73.66)	1.905 (48.4)	750 (5171)	10,000 (68.9)*
2-3/8 (60.3)**	3.063 (77.8)	2.90 (73.66)	1.905 (48.4)	1,000 (6894)	15,000 (103.4)**
2-7/8 (73.0)*	3.66 (92.96)	3.46 (87.88)	2.45 (62.2)	500 (3447)	5,000 (34.5)*
2-7/8 (73.0)*	3.66 (92.96)	3.46 (87.88)	2.45 (62.2)	750 (5171)	10,000 (68.9)*
2-7/8 (73.0)**	3.66 (92.96)	3.46 (87.88)	2.45 (62.2)	1,000 (6894)	15,000 (103.4)**

***Denotes L80 (NACE Sour Service)Material and **Denotes P110 (Non-Sour Service)**

Material required to meet Engineered Tool Burst Ratings

Comparable Otis® Profiles Otis® is a registered trademark of Halliburton Energy Services

	COMBO RUPTURE DISC® SPECIFICATIONS				COMBO RUPTURE DISC®SPECIAL CLEARANCE (SC)			
DESCRIPTION	**2-3/8 (60.3mm)**		**2-7/8 (73mm)**		**SC 2-3/8 (60.3mm)**		**SC 2-7/8 (73mm)**	
Maximum OD	3.063 in	77.8 mm	3.69 in	93.6 mm	2.90 in	73.66 mm	3.46 in	87.88 mm
Overall Length	18.373 in	466.67 mm	18.242 in	463.35 mm	18.373 in	466.67 mm	18.242 in	463.35 mm
Pressure Options	5,000 psi (34.45 Mpa)*		10,000 psi (68.9 Mpa)*		15,000psi (103.35 Mpa)**			
Min & Max Temp.	-40c (-40F) 160c (320F) with HSN (Sour Service) seals. Temperature rated seals above 160c (320F) can be supplied upon request							
Tensile Strength*	141 200 lbs	62.808 daN	170 000 lbs	75.650 daN	81 200 lbs	36.120 daN	122 000 lbs	54.290 daN
Tensile Strength**	194 100 lbs	86.340 daN	234 000 lbs	104.130 daN	111 700 lbs	49.687 daN	168 000 lbs	74.760 daN
Internal Yield Pressure*	13 900 psi	95.84 Mpa	14500 psi	99.97 Mpa	10 300 psi	71.02 Mpa	10 700 psi	73.77 Mpa
Internal Yield Pressure**	19 200 psi	132.38 Mpa	19900 psi	137.20 Mpa	14 200 psi	97.91 Mpa	14 700 psi	101.35 Mpa
Collapse Pressure*	12 700 psi	87.56 Mpa	13200 psi	91.01 Mpa	8 600 psi	59.29 Mpa	9 200 psi	63.43 Mpa
Collapse Pressure**	17 500 psi	120.66 Mpa	18100 psi	124.79 Mpa	10 700 psi	73.77 Mpa	11 600 psi	79.97 Mpa
Torque Through Body Specs-L80	Must not exceed 2593 ft-lbs		Must not exceed 4606 ft-lbs		Must not exceed 1367 ft-lbs		Must not exceed 2759 ft-lbs	
Connection	2-3/8 in (60.3mm) EUE		2-7/8 in (73mm) EUE		SC 2-3/8 in (60.3mm) EUE		SC 2-7/8 in (73 mm) EUE	
AOX Profile	1.875 in	47.63 mm	2.318"	58.88 mm	1.875 in	47.63 mm	2.318 in	58.88 mm
AOXN Profile	1.875 in	47.63 mm	2.318"	58.88 mm	1.875 in	47.63 mm	2.318 in	58.88 mm
No Go (AXN)	1.79 in	45.47 mm	2.208"	56.08 mm	1.79 in	45.47 mm	2.208 in	56.08 mm
AOR Profile	1.875 in	47.63 mm			1.875 in	47.63 mm		
AORN Profile	1.875 in	47.63 mm			1.875 in	47.63 mm		
No Go (ARN)	1.716 in	43.59 mm			1.716 in	43.59 mm		
Material/Metal*	L80 NACE*	L80 NACE*	L80 NACE*	L80 NACE*	L80 NACE*	L80 NACE*	L80 NACE*	L80 NACE*
Material/Metal**	P110**	P110**	P110**	P110**	P110**	P110**	P110**	P110**

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45 – 50 – 55 HD Series

Armor Casing Floatation (ACF) Device

Protecting Your "Assets"

The Armor Casing Floatation (ACF) Device is engineered and enhanced to create a pressure/ fluid load barrier in assisting the operator's abilities of landing their casing in long lateral sections of Horizontal wells.

With a Float shoe installed at the very bottom of the casing string and the ACF Device installed strategically in the casing string in a predetermined location creates a buoyancy in the lower leg of the casing string. This buoyancy reduces friction up to 50% while enhancing the weight of the vertical section provide increased forces assist sliding the casing string to the toe of the well.

The Armor Rupture Disc enhances the Floatation Tool with a shatter pattern that breaks into miniscule pieces not requiring a debris trap/catcher. Secondly, the ID separation groove insures the producer has a Full Bore ID. Once the casing string is at your required depth, the Armor Rupture Disc® can be removed by over pressuring the Discs pressure rating. No mechanical breaking required.

(See data sheet for Rupturing differentials)

Features & Benefits

- ✓ **Designed to Float casing into place**
- ✓ **The only FULL BORE opening Floatation device in the industry**
- ✓ **No mechanical breaking required**
- ✓ **Available in 5k, 10k & 15K pressure ratings (Can custom build to other pressures)**
- ✓ **All Armor Casing Floatation Devices are manufactured with P-110 material**
- ✓ **Anti-Rotation set screws prevent threads from disengaging during downhole manipulation of the casing string.**
- ✓ **New Body Torque through capability (See spec sheet for allowed torque)**
- ✓ **Patented Rupture Disc® with Bore ID separation groove &shatter pattern**
- ✓ **New and Improved Lo-Hi pressure seal engaging design (Patent Pending)**
- ✓ **All Armor Casing Floatation Devices are pressure tested, charted and serialized for full traceability**
- ✓ **Customers can special order any size, material, threads, coatings & special hardenings**
- ✓ **ISO Compliant**

Recommended Running Procedures

1. **Insure the Armor Casing Device is transported from the Manufacture to the End-Users location in "Safe Trip Package".**
2. **Loading fluid weight in a slow consistent manner**
3.

NOT FOLLOWING THE OUT LINED RECOMMENDATINS COULD RESULT IN PRODUCT FAILURE

45 – 50 – 55 HD Series

Armor Casing Floatation (ACF) Device

ARMOR CASING FLOATATION (ACF) DEVICE – AVAILABLE SIZES

TOOL DESCRIPTION inch (mm)	Tool Casing Weight Lb-ft / kg-m	TOOL Material (available)	CONCAVE SIDE psi (mpa) Rupturing differential	CONVEX SIDE psi (mpa) Disc Rating
4-1/2 (114.3)	11.6-15.10/17.26-22.47	L80 / P110	500 (3447)	5 000 (34.5)
4-1/2 (114.3)	11.6-15.10/17.26-22.47	L80 / P110	750 (5171)	10 000 (68.9)
4-1/2 (114.3)	11.6-15.10/17.26-22.47	L80 / P110	1 000 (6894)	15 000 (103.4)
5 (127.0mm)	13.0-18.0 / 18.0-26.80	L80 / P110	500 (3447)	5 000 (34.5)
5 (127.0mm)	13.0-18.0 / 18.0-26.80	L80 / P110	750 (5171)	10 000 (68.9)
5 (127.0mm)	13.0-18.0 / 18.0-26.80	L80 / P110	1 000 (6894)	15 000 (103.4)
5-1/2 (139.7)	17.0-23.0 / 25.3-34.23	L80 / P110	500 (3447)	5 000 (34.5)
5-1/2 (139.7)	17.0-23.0 / 25.3-34.23	L80 / P110	750 (5171)	10 000 (68.9)
5-1/2 (139.7)	17.0-23.0 / 25.3-34.23	L80 / P110	1 000 (6894)	15 000 (103.4)
Custom Casing sizes / weight available **Custom Rupture pressure rating available with lead time**				

Armor AOX/AOXN Profile Nipples

AOX Wireline Profile Nipple

The AOX Wireline Nipple is a selective landing nipple that allows for the locationand installation of multiple flow control devices such as blanking plugs, bottom hole chokes etc. This profile nipple design has two locking grooves and a seal bore which allows for the internal locking of flow control devices. The design of the AOX Wireline Profile Nipple allows for multiple AOX nipples to be run in the tubing string.

Features& Benefits

- ✓ **Allows installation of multiple flow control devices**
- ✓ **Locking grooves, seal bore provides means to lock and seal various flow control equipment into the profile nipple.**
- ✓ **Design Allows for multiple AOX nipples to be run in the completion string**
- ✓ **Available in Special Clearance design**
- ✓ **Can be special order in any material, threads, coatings or special hardenings**
- ✓ **Drifted and Lockset tested with calibrated Genuine Otis® tools**
- ✓ **Comparable Otis® Profiles** **Otis® is a registered trademark of Halliburton Energy Services**

AOXN Wireline Profile Nipple

The AOXN Wireline Profile Nipple is a bottom no-go landing profile nipple that allows for the location and installation of many flow control devices such as blanking plugs, recorders, etc. This profile nipple design has two locking grooves and a seal bore which allows for the internal locking of flow control devices. The bottom no-go shoulder provides the means to positively locate the appropriate flow control device.

Features& Benefits

- ✓ **Bottom no-go wireline profile nipple**
- ✓ **Allows installation of various flow control devices**
- ✓ **Locking groove, seal bore provides means to lock and seal various flow control equipment into the profile nipple.**
- ✓ **Bottom no-go acts as a tool catcher, positive locator of profile nipple and flow control equipment.**
- ✓ **Can be special ordered in any material, threads, coatings or special hardenings**
- ✓ **Drifted and Lockset tested with calibrated Genuine Otis® tools**
- ✓ **Comparable Otis® Profiles** **Otis® is a registered trademark of Halliburton Energy Services**

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Armor AOX/AOXN Profile Nipples

Guide to Types AOX, AOXN, AOR and AORN Otis® Landing Nipples

TUBING SIZE				FOR STANDARD TUBING WEIGHTS (INCHES)				FOR HEAVY WEIGHT TUBING	
OD	WEIGHT	ID	DRIFT	AOX NIPPLE BORE (ins)		AOXN NO-GO IS (ins)		AOR PACKING	AORN NO-GO ID
(ins)	(per foot)	(ins)	(ins)	STANDARD	OPTIONAL	STANDARD	OPTIONAL	BORE (ins)	(inches)
2.063	3.25	1.751	1.657	1.625		1.536			
	3.4	1.750	1.657						
	4.6	1.995	1.901	1.875	1.905	1.791			
	4.7	1.995	1.901						
2.375	5.3	1.939	1.845					1.781	1.640
	5.95	1.867	1.775					1.710	1.560
	6.2	1.853	1.759						
	7.7	1.703	1.609					1.500	1.345
	6.4	2.441	2.347	2.313	2.380	2.205			
	6.5	2.441	2.347						
	7.9	2.323	2.229					2.188	2.010
	8.7	2.259	2.165					2.125	1.937
	8.9	2.243	2.149						
2.875	9.5	2.195	2.101					2.000	1.881
	10.4	2.151	2.057						
	10.7	2.091	1.997						
	11.0	2.065	1.971					1.875	1.716
	11.65	1.995	19.01						
	9.3	2.992	2.867	2.813	2.875	2.635	2.760		
	10.3	2.992	2.979	2.750	2.813				
	12.8	2.764	2.639					2.562	2.329
3.500	12.95	2.750	2.625						
	15.8	2.548	2.423					2.313	2.131
	16.7	2.480	2.355						
	17.05	2.440	2.315					2.188	2.010
	10.9	3.476	3.351	3.313		3.135			
4.000	11.0	3.476	3.351						
	11.6	3.428	3.303					3.250	3.088
	13.4	3.340	3.215					3.125	2.907
	12.75	3.958	3.833	3.813		3.725		3.813	
	13.5	3.920	3.795					3.688	3.456
4.500	15.5	3.826	3.701						
	16.9	3.754	3.629					3.437	3.162
	19.2	3.640	3.515					3.437	3.162
	13.00	4.494	4.369	4.313				4.125	3.913
5.000	15.00	4.408	4.283					4.125	3.912
	18.00	4.276	4.151					4.000	3.748
7.000	17-32	-	-					5.962	5.750

**The above dimensions apply to SSDs and other Otis® (Armor Tools) equipment having integral landing nipple profiles.*

Otis® is a registered trademark of Halliburton Energy Services

AOX & AOXN abbreviated for (A) Armor (O) Otis®'X'&'XN' profiles

AOR & AORN abbreviated for (A) Armor (O) Otis®'R'&'RN' profile

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Armor AOR/AORN Profile Nipples

AOR Wireline Profile Nipple

The AOR Wireline Nipple is a selective landing nipple that allows for the location and installation of multiple flow control devices such as blanking plugs, bottom hole chokes etc. This profile nipple design has three locking grooves and a seal bore which allows for the internal locking of flow control devices. The design of the AOR wireline profile nipple allows for multiple AOR nipples to be run in the tubing string.

Features & Benefits

- ✓ **Allows installation of multiple flow control devices**
- ✓ **Locking grooves and seal bore provide the means to lock and seal various flow control equipment into the profile nipple**
- ✓ **Design Allows for multiple AOR nipples to be run in the completion string**
- ✓ **Available in Special Clearance design**
- ✓ **Can be special order in any material, threads, coatings or special hardenings**
- ✓ **Drifted and Lockset tested with calibrated Genuine Otis® tools**
- ✓ **Comparable Otis® Profiles** **Otis® is a registered trademark of Halliburton Energy Services**

AORN Wireline Profile Nipple

The AORN Wireline Profile Nipple is a bottom no-go landing profile nipple that allows for the location and installation of many flow control devices such as blanking plugs, recorders, etc. This profile nipple design has three locking grooves and a seal bore which allows for the internal locking of flow control devices. The bottom no-go shoulder provides the means to positively locate the appropriate flow control device.

Features & Benefits

- ✓ **Bottom no-go wireline profile nipple**
- ✓ **Allows installation of various flow control devices**
- ✓ **Locking groove and seal bore provides the means to lock and seal various flow control equipment into the profile nipple**
- ✓ **Bottom no-go acts as a tool catcher, positive locator of profile nipple, and flow control equipment**
- ✓ **Can be special order in any material, threads, coatings or special hardenings**
- ✓ **Drifted and Lockset tested with calibrated Genuine Otis® tools**
- ✓ **Comparable Otis® Profiles** **Otis® is a registered trademark of Halliburton Energy Services**

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Armor AOR/AORN Profile Nipples

Guide to Types AOX, AOXN, AOR and AORN Otis® Landing Nipples

TUBING SIZE				FOR STANDARD TUBING WEIGHTS (INCHES)				FOR HEAVY WEIGHT TUBING	
OD	WEIGHT	ID	DRIFT	AOX NIPPLE BORE (ins)		AOXN NO-GO IS (ins)		AOR PACKING	AORN NO-GO ID
(ins)	(per foot)	(ins)	(ins)	STANDARD	OPTIONAL	STANDARD	OPTIONAL	BORE (ins)	(inches)
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	3.4	1.750	1.657						
	4.6	1.995	1.901	1.875	1.905	1.791			
	4.7	1.995	1.901						
2.375	5.3	1.939	1.845					1.781	1.640
	5.95	1.867	1.775					1.710	1.560
	6.2	1.853	1.759						
	7.7	1.703	1.609					1.500	1.345
	6.4	2.441	2.347	2.313	2.380	2.205			
	6.5	2.441	2.347						
	7.9	2.323	2.229					2.188	2.010
	8.7	2.259	2.165					2.125	1.937
	8.9	2.243	2.149						
2.875	9.5	2.195	2.101					2.000	1.881
	10.4	2.151	2.057						
	10.7	2.091	1.997						
	11.0	2.065	1.971					1.875	1.716
	11.65	1.995	19.01						
	9.3	2.992	2.867	2.813	2.875	2.635	2.760		
	10.3	2.992	2.979	2.750	2.813				
	12.8	2.764	2.639					2.562	2.329
3.500	12.95	2.750	2.625						
	15.8	2.548	2.423					2.313	2.131
	16.7	2.480	2.355						
	17.05	2.440	2.315					2.188	2.010
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4.000	11.0	3.476	3.351						
	11.6	3.428	3.303					3.250	3.088
	13.4	3.340	3.215					3.125	2.907
	12.75	3.958	3.833	3.813		3.725		3.813	
	13.5	3.920	3.795					3.688	3.456
4.500	15.5	3.826	3.701						
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AOX & AOXN abbreviated for (A) Armor (O) Otis®'X'&'XN' profiles

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Pump Out Plugs (POP)

Description

The POP – Pump out Plug is used in the following applications but not limited to. Place on the bottom of production tubing string the POP can work as a staging tool when running in full joints below a perf pup. Used as a frac ball stop in completions when not all the frac balls have been recovered or concerns of dissolving frac ball stilling being present during completion and flowing of the well.

Features & Benefits

- ✓ Field adjustable shear screws
- ✓ Aluminum inserts
- ✓ Full tubing I.D. once insert is expended
- ✓ Temporary plug

Armor Tools Pump out Plug Shear Screw Guide

Number of Brass Set Screws	Pressure for ¼" Shear Screw Min/Max (PSI)
Each	342 – 418
2	684 - 836
3	1026 - 1254
4	1368 - 1672
5	1710 - 2090
6	2052 - 2508
7	2394 - 2926
8	2736 - 3344
Must Be used with a minimum of two shear screws	
Note; Shear screws are brass, Shear values are +/- 10 %	

Re-Entry / No-Go Re-Entry Guides

Description

Wireline Re-entry Guides are used for safe re-entry of wireline tools from the casing into the tubing string. Threaded on the top end only, they attach to the bottom end of the production string and are designed with a beveled guide and increased internal diameter. Certain tools such as tubing end locators or sample bailers are designed to be run out of the tubing to perform their tasks. The Wireline Re-entry Guide, with its internal bevel, guides the wireline or slickline tool string back into the tubing.

Adding a Single or Double brass bar stock to the Re-entry Guidewas introduced to the industry to assist in preventing unrecovered Frac balls from blocking the flow of fluids thru the tubing.

An additional innovation by Armor Tools was the development of the No-Go Re-entry Guide. This development fulfills the need for a flow control device that aids in stopping unrecovered Frac ballsand gives the well operator the ability to install recorders on the bottom side of the tubing string.

Features& Benefits

- ✓ **One piece construction.**
- ✓ **Special clearance and L80 standard stock**
- ✓ **Brass Bar stops are easily sheared with coil tubing**
- ✓ **Multiple no-go sizes to meet your well's requirements**
- ✓ **Custom sizes and configurations available upon request**
- ✓ **Available with Mule Shoe design to aidtubing deployment in deviated wells**

TECHNICAL DATA

API TUBING	OD STANDARD	O.D. SPECIAL CLEARANCE	I.D.
	in / mm	in / mm	in / mm
2-3/8 (60.3mm)	3.03 in / 76.96 mm	2.90 in / 73.66 mm	2.00 in / 50.80 mm
2-7/8 (70.3mm)	3.69 in / 93.60 mm	3.46 in / 87.88 mm	2.92 in / 74.17 mm
3-1/2 (88.9mm)	4.475 in / 113.66 mm	4.187 in / 106.35 mm	3.57 in / 90.67 mm

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Re-Entry / No-Go Re-Entry Guides

Re-Entry Guides / No-Go Re-Entry Guides J55 & L80

1. Re-Entry Guide: 2-3/8 EUE – Regular
2. Re-Entry Guide: 2-3/8 EUE – Shaved (SC)
3. Re-Entry Guide: 2-3/8 EUE – Regular c/w 1 brass bar stop
4. Re-Entry Guide: 2-3/8 EUE – Regular c/w 2 brass bar stop
5. Re-Entry Guide: 2-3/8 EUE – SC c/w 1 brass bar stop
6. Re-Entry Guide: 2-3/8 EUE – SC c/w 2 brass bar stop

7. Re-Entry Guide: 2-3/8 EUE – SC 1.71 No-Go
8. Re-Entry Guide: 2-3/8 EUE – SC 1.71 No-Go c/w 1 brass bar stop
9. Re-Entry Guide: 2-3/8 EUE – SC 1.71 No-Go c/w 2 brass bar stop

10. Re-Entry Guide: 2-3/8 EUE – SC 1.79 No-Go
11. Re-Entry Guide: 2-3/8 EUE – SC 1.79 No-Go c/w 1 brass bar stop
12. Re-Entry Guide: 2-3/8 EUE – SC 1.79 No-Go c/w 2 brass bar stop

13. Re-Entry Guide: 2-3/8 EUE – SC 1.81 No-Go
14. Re-Entry Guide: 2-3/8 EUE – SC 1.81 No-Go c/w 1 brass bar stop
15. Re-Entry Guide: 2-3/8 EUE – SC 1.81 No-Go c/w 2 brass bar stop

16. Re-Entry Guide: 2-7/8 EUE – Regular
17. Re-Entry Guide: 2-7/8 EUE – Shaved (SC)
18. Re-Entry Guide: 2-7/8 EUE – Regular c/w 1 brass bar stop
19. Re-Entry Guide: 2-7/8 EUE – Regular c/w 2 brass bar stop
20. Re-Entry Guide: 2-7/8 EUE – SC c/w 1 brass bar stop
21. Re-Entry Guide: 2-7/8 EUE – SC c/w 2 brass bar stop

22. Re-Entry Guide: 3-1/2 EUE – Regular
23. Re-Entry Guide: 3-1/2 EUE – Shaved (SC)
24. Re-Entry Guide: 3-1/2 EUE – Regular c/w 1 brass bar stop
25. Re-Entry Guide: 3-1/2 EUE – Regular c/w 2 brass bar stop
26. Re-Entry Guide: 3-1/2 EUE – SC c/w 1 brass bar stop
27. Re-Entry Guide: 3-1/2 EUE – SC c/w 2 brass bar stop

Mule Shoe Re-Entry Guides /Mule Shoe No-Go Re-Entry Guides J55 & L80

1. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – Regular
2. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – Shaved (SC)
3. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – Regular c/w 1 brass bar stop
4. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – Regular c/w 2 brass bar stop
5. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – SC c/w 1 brass bar stop
6. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – SC c/w 2 brass bar stop

7. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – SC 1.71 No-Go
8. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – SC 1.71 No-Go c/w 1 brass bar stop
9. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – SC 1.71 No-Go c/w 2 brass bar stop

10. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – SC 1.79 No-Go
11. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – SC 1.79 No-Go c/w 1 brass bar stop
12. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – SC 1.79 No-Go c/w 2 brass bar stop

13. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – SC 1.81 No-Go
14. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – SC 1.81 No-Go c/w 1 brass bar stop
15. Re-Entry Guide/Mule Shoe: 2-3/8 EUE – SC 1.81 No-Go c/w 2 brass bar stop

16. Re-Entry Guide/Mule Shoe: 2-7/8 EUE – Regular
17. Re-Entry Guide/Mule Shoe: 2-7/8 EUE – Shaved (SC)
18. Re-Entry Guide/Mule Shoe: 2-7/8 EUE – Regular c/w 1 brass bar stop
19. Re-Entry Guide/Mule Shoe: 2-7/8 EUE – Regular c/w 2 brass bar stop
20. Re-Entry Guide/Mule Shoe: 2-7/8 EUE – SC c/w 1 brass bar stop
21. Re-Entry Guide/Mule Shoe: 2-7/8 EUE – SC c/w 2 brass bar stop

22. Re-Entry Guide/Mule Shoe: 3-1/2 EUE – Regular
23. Re-Entry Guide/Mule Shoe: 3-1/2 EUE – Shaved (SC)
24. Re-Entry Guide/Mule Shoe: 3-1/2 EUE – Regular c/w 1 brass bar stop
25. Re-Entry Guide/Mule Shoe: 3-1/2 EUE – Regular c/w 2 brass bar stop
26. Re-Entry Guide/Mule Shoe: 3-1/2 EUE – SC c/w 1 brass bar stop
27. Re-Entry Guide/Mule Shoe: 3-1/2 EUE – SC c/w 2 brass bar stop

All Armor Tools Brass Bar Stops are 5/32”s material

EXAMPLE: Multiply Shear Force (Brass 5/32 (760psi)) for 2 points of shear = 1520psi of shear force

Custom sizes can be used upon request

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Saw Tooth End Mill

Description

Unlike re-entry guides the Saw Tooth End Mill primary purpose is to breakup downhole sand bridges, ice plugs, etc. This simplified mill allows the producer to mill out such sand bridges without the need of a bit, which then would require the producer to drop off the bit downhole to allow proper flow of the producing well and or spend more time and cost by removing the bit entirely.

Benefits & Features

- ✓ **Available in various sizes**
- ✓ **Available in various material grades J55, L80, etc.**
- ✓ **Available in multiple threads. EUE being the most common**
- ✓ **Manufactured as one complete part**

Nominal Saw Tooth End Mill Sizes

- **2-3/8 (60.3mm) EUE J55**
- **2-3/8 (60.3mm) EUE J55 (Special Clearance)**
- **2-3/8 (60.3mm) EUE L80**
- **2-3/8 (60.3mm) EUE L80 (Special Clearance)**
- **2-7/8 (73.0mm) EUE J55**
- **2-7/8 (73.0mm) EUE J55 (Special Clearance)**
- **2-7/8 (73.0mm) EUE L80**
- **2-7/8 (73.0mm) EUE L80 (Special Clearance)**
- **3-1/2 (88.9mm) EUE J55**
- **3-1/2 (88.9mm) EUE J55 (Special Clearance)**
- **3-1/2 (88.9mm) EUE L80**
- **3-1/2 (88.9mm) EUE L80 (Special Clearance)**

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Pump Seat Nipples

Description:

PSN's – Pump Seating Nipples are used to seat rod pumps as an anchor point for the lower portion of the rod string. PSN's can also be have set mechanical plugs set across their body but is not a recommended practice if used while snubbing.

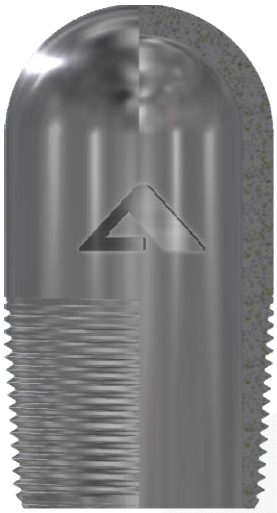
Features:

- ✓ Economical anchor for seating rods
- ✓ Built to API Standards

PSN Sizes available

Sizes SAE / Metric	Tool ID's SAE / Metric
2-3/8" / 60.3 mm	1.78" / 45.2 mm
2-7/8" / 73.0 mm	2.28" / 57.9 mm
3-1/2" / 89.0 mm	2.78" / 70.6mm
Other Sizes available upon request	

Bull Plugs



Description

A threaded nipple with a rounded, closed end used to close off the end of a line. Used in the Oil & Gas field from well testing equipment, to wellheads and producing strings.

Features & Benefits

- ✓ **Available in various sizes**
- ✓ **Available in a variety of material grades.**
- ✓ **Available in multiple threads.**
- ✓ **Manufactured as one complete part**
- ✓ **Available with a ½" NPT thread port**

Nominal Bull Plug Sizes Available

- **1.66 NUE J55**
- **1.66 NUE L80**
- **1.99 NUE J55**
- **1.99 NUE L80**
- **2-3/8 (60.3mm) EUE J55**
- **2-3/8 (60.3mm) EUE L80**
- **2-7/8 (73.0mm) EUE J55**
- **2-7/8 (73.0mm) EUE L80**
- **3-1/2 (89.0mm) EUE J55**
- **3-1/2 (89.0mm) EUE L80**

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Couplings

Description

API couplings are used to connect tubular joints together. They come in a variety of threads and material grades. At times Special Clearance (Shaved) Couplings are required such to fit through casing patches.

Features & Benefits

- ✓ **Available in various sizes**
- ✓ **Available in avariety of material grades. J55, L80, etc.**
- ✓ **Available in multiple threads. EUE being the most common**
- ✓ **Manufactured as one complete part**

Nominal Coupling Sizes Available

- **1.66 NUE J55**
- **1.66 NUE L80**
- **1.99 NUE J55**
- **1.99 NUE L80**
- **2-3/8 (60.3mm) EUE J55**
- **2-3/8 (60.3mm) EUE J55 (Special Clearance)**
- **2-3/8 (60.3mm) EUE L80**
- **2-3/8 (60.3mm) EUE L80 (Special Clearance)**
- **2-7/8 (73.0mm) EUE J55**
- **2-7/8 (73.0mm) EUE J55 (Special Clearance)**
- **2-7/8 (73.0mm) EUE L80**
- **2-7/8 (73.0mm) EUE L80 (Special Clearance)**
- **3-1/2 (89.9mm) EUE J55**
- **3-1/2 (89.9mm) EUE J55 (Special Clearance)**
- **3-1/2 (89.9mm) EUE L80**
- **3-1/2 (89.9mm) EUE L80 (Special Clearance)**

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Pup Joints

API Pup Joints

API Pup Joints come in a variety of lengths, sizes and materials. Pup joints are used in many scenarios for strategical spacing out packers, blast joints, profiles, and Rupture Discs® PSN's, fishing and tubing strings.
Standard API Pup Joints sizes:

- **2-3/8's (60.3mm)**
- **2-7/8's (73.0 mm)**
- **3-1/2's (88.9mm)**

Features and Benefits

- ✓ **Available in multiple tubing Lengths**
- ✓ **Available in multiple tubing sizes**
- ✓ **Available in multiple tubing grades. J55, L80, etc.**
- ✓ **Available in API or premium thread connections**

Nominal API Pup Joints Sizes Available in J55 & L80

- **2-3/8 EUE 2 ft**
- **2-3/8 EUE 4 ft**
- **2-3/8 EUE 6 ft**
- **2-3/8 EUE 8 ft**
- **2-3/8 EUE 10 ft**
- **2-3/8 EUE 12 ft**

- **2-7/8 EUE 2 ft**
- **2-7/8 EUE 4 ft**
- **2-7/8 EUE 6 ft**
- **2-7/8 EUE 8 ft**
- **2-7/8 EUE 10 ft**
- **2-7/8 EUE 12 ft**

- **3-1/2 EUE 2 ft**
- **3-1/2 EUE 4 ft**
- **3-1/2 EUE 6 ft**
- **3-1/2 EUE 8 ft**
- **3-1/2 EUE 10 ft**
- **3-1/2 EUE 12 ft**

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Perforated – Slotted Pup Joints

Description

Perforated - Slotted Pup Joints are various lengths of tubing with predetermined machined holes or slots situated at either 45° or 90° apart along the length of the tubing. Perforated - Slotted Pup Joints are usually installed near or at the bottom of the completion tubing string. When installed between two profile nipples, downhole recording devices such as temperature and pressure gauges can be installed in the lower profile nipple to acquire flowing pressure and temperature measurements.

In other well completion proposes the Perforated / Slotted Pup Joints provide unrestricted flow of fluid & gas when Frac balls are not recovered.

Features& Benefits

- ✓ **Available in multiple tubing lengths**
- ✓ **Available in multiple tubing sizes**
- ✓ **Available in multiple tubing grades**
- ✓ **Available in API or other premium thread connections**

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Perforated – Slotted Pup Joints

2-3/8 Slotted PJ

Tubing Flow 3.3 sq in			2x Tubing Flow= 6.6 sq in		3x Tubing Flow= 9.9 sq in	
Length (ft)	Slotted Columns	Degrees	# of Slots	Length of Slot (in)	Slot Width (in)	Flow Achieved
2'	8	45	8	12	0.114	10.94 sq. in.
4'	4	90	6	16	0.114	10.94 sq. in.
6'	4	90	10	12	0.114	13.68 sq. in.
8'	4	90	10	12	0.114	13.68 sq. in.
10'	4	90	10	12	0.114	13.68 sq. in.

2-3/8 Perforated PJ

Tubing Flow 3.3 sq in			2x Tubing Flow= 6.6 sq in		3x Tubing Flow= 9.9 sq in	
Length (ft)	Hole Columns	Degrees	# of Holes	Size (in)	Flow /Hole	Flow achieved
2'	4	90	10	1"	0.7854	7.85 sq. in.
4'	4	90	18	3/4"	0.4418	7.95 sq. in.
6'	4	90	22	5/8"	0.3068	6.75 sq. in.
8'	4	90	26	5/8"	0.3068	7.98 sq. in.
10'	4	90	34	5/8"	0.3068	10.43 sq. in.

2-7/8 Slotted PJ

Tubing Flow 4.71 sq in			2x Tubing Flow= 9.42 sq in		3x Tubing Flow= 14.13 sq in	
Length (ft)	Slotted Columns	Degrees	# of Slots	Length of Slot (in)	Slot Width (in)	Flow Achieved
2'	8	45	8	15	0.114	13.68 sq. in.
4'	8	45	12	12	0.114	16.42 sq. in.
6'	4	90	10	14	0.114	15.96 sq. in.
8'	4	90	10	14	0.114	15.96 sq. in.
10'	4	90	10	14	0.114	15.96 sq. in.

2-7/8 Perforated PJ

Tubing Flow 4.71 sq in			2x Tubing Flow= 9.42 sq in		3x Tubing Flow= 14.13 sq in	
Length (ft)	Hole Columns	Degrees	# of Holes	Size (in)	Flow /Hole	Flow achieved
2'	4	90	10	1"	0.7854	7.85 sq. in.
4'	4	90	18	3/4"	0.4418	7.95 sq. in.
6'	4	90	22	3/4"	0.4418	9.72 sq. in.
8'	4	90	26	3/4"	0.4418	11.49 sq. in.
10'	4	90	34	3/4"	0.4418	15.02 sq. in.

Custom Slotted and Perforated Pup Joints Upon Request

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Blast Joints

Description

Blast Joints are used to protect the tubing string from the abrasive action of flowing gas or fluids when positioned across perforations. Blast Joints may also be used directly below the well head to the tubing string from the abrasion of doing a hydraulic fracturing operation down the annulus. Blast Joints are made from high quality steel treated to between 28 & 36 Rc hardness to insure maximum abrasion resistance and strength. For H2S service, the Blast Joint is available in a heat treated hardness of 18 & 22 Rc as per Nace specification MR-01-75. Other materials are available if required. Full tubing ID is maintained through the bore of the Blast Joint. The OD measures the same as a standard coupling. Standard Blast Joints have an API EUE thread connection. Custom thread can be ordered.

Features& Benefits

- ✓ **Full bore ID**
- ✓ **Available in a selection of lengths**
- ✓ **Available in a selection of tubing sizes**
- ✓ **Available in a variety of connections**
- ✓ **Available in a variety of materials**

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Swages

Description

Swages come in all sizes, dimensions and material. Used primarily in the completion stringing to cross over from one size of tubing to another or accommodate specialty thread differences. Such examples would be packers, special clearance valves, etc.

Features & Benefits

- ✓ **Available in various sizes**
- ✓ **Available in a variety of material grades. J55, L80, etc.**
- ✓ **Available in multiple threads. EUE being the most common**
- ✓ **Manufactured as on complete part**

Nominal Swage Sizes Available

- **PxP 2-3/8 x 2-7/8 EUE**
- **PxP 2-7/8 x 3-1/2EUE**

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