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ERA Casing and Cement Accessories

for

Arrow Energy RFQ 103665

25th March 25, 2019



Contents

Centralizer	3
Non-Welded Straight Bow Spring Centralizer (hinged)	3
Features:	3
Specifications:	4
Installation Instructions:	5
Storage and Handling Instructions:.....	5
Semi-Rigid Centralizer	6
Features:	6
Dimensions:.....	6
Storage and handling instructions:	7
Fixed Rigid Centralizer.....	8
Features:	8
Dimensions:.....	8
Running Instructions:	8
Storage and Handling Instructions:.....	8
Stop Collar	9
Features:	9
Set Screw Type Stop Collar	9
Bolt Type Stop Collar.....	9
Dimensions:	10
Bolt Type Stop Collar.....	10
Set Screw Type Stop Collar	11
Running Instructions:	11
Storage and handling instructions:	11
Non-Rotating Surface Release Cementing Plug	12
Features:	12
Dimensions:.....	13
Combination Plug, non-R	14
Dimensions:.....	14
Storage and handling instructions:	14
Non- Rotating Float Collar & Float Shoe	15



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Features:	15
Dimensions :.....	16
Running instructions:	16
Storage and Handling Instructions:.....	17
Guide Shoe	18
Features:	18
Dimensions:.....	18
Storage and handling instructions:	18
Cementing Basket	19
Features:	19
Dimensions:.....	19
Running instructions:	19
Storage and handling instructions:	20

Centralizer

Non-Welded Straight Bow Spring Centralizer (hinged)

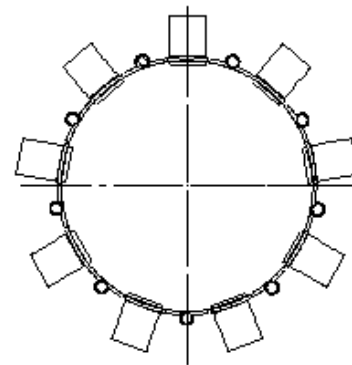
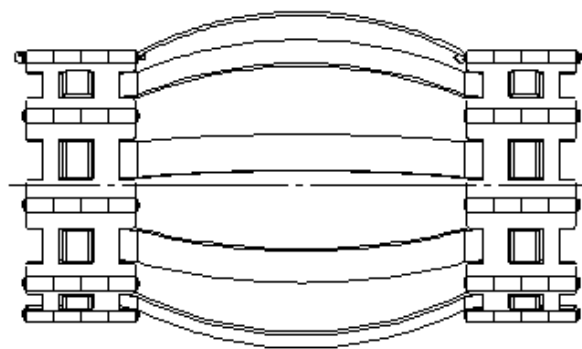
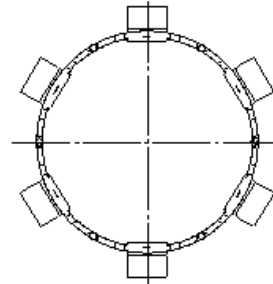
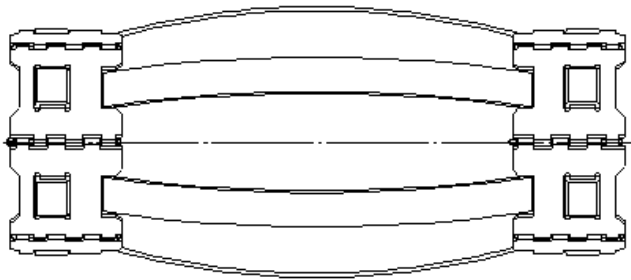
Features:

- High-performance bows provide maximum standoff in multiple locations of the annulus, providing the best possible conditions for primary cement to achieve zonal isolation.
- Tested to meet and exceed American Petroleum Institute API 10D requirements for restoring and starting force, providing reliability and durability for operations.
- Non-welded design can withstand most wellbore environments, providing operational flexibility.
- Bow configurations are available in various heights and sizes suitable for most applications.
- Suited for vertical and deviated well bore, Cased and open holes .Wells where rotation capabilities are not required.
- Hinged design allows for convenient field installation.
- Can be unfolded and stacked flatly, saving storage and transportation cost.
- Improves displacement efficiency when installed with turbo blade.



Specifications:

Bow spring centralizers in different size with different numbers of bows.



The Max OD is specially designed for Arrow and it is recommended to run in vertical section wells to meet standoff requirements but not recommend running in horizontal and highly deviated section of wells.

Casing Size (in)	Casing size (in)	Hole size(in)	Max OD (in)	Height (mm)	Number of spring bow	Max. Staring force(N)	Max Restoring force (KN)
7 to 8 1/2	7	8 1/2	8 1/2	565 ± 5	6	0	1000
8 5/8 to 9 7/8	8 5/8	9 7/8	9 7/8	565 ± 5	8	0	2300
9 5/8 to 12 1/4	9 5/8	12 1/4	12 1/4	565 ± 5	9	0	2500
10 3/4 to 12 1/4	10 3/4	12 1/4	12 1/4	565 ± 5	9	0	1700



MAX OD adjusted with improved performance for restoring force

Casing Size (in)	Casing size (in)	Hole size(in)	MAX OD(in)	Height(mm)	Number of spring bow	Max. Staring force(N)	Min. Restoring force at 67% standoff(N)
7 to 8 1/2	7	8 1/2	9.13 ± 0.2	565 ± 5	6	4626(As per API 10D)	4626(As per API 10D)
8 5/8 to 9 7/8	8 5/8	9 7/8	10.43 ± 0.2	565 ± 5	8	6405(As per API 10D)	6405(As per API 10D)
9 5/8 to 12 1/4	9 5/8	12 1/4	13.19 ± 0.2	565 ± 5	9	7117(As per API 10D)	7117(As per API 10D)
10 3/4 to 12 1/4	10 3/4	12 1/4	13.19 ± 0.2	565 ± 5	9	9074(As per API 10D)	4537(As per API 10D)

Installation Instructions:

All bow spring centralizers must be installed either over casing couplings or Stop Collars

Storage and Handling Instructions:

Product should be stored in dry warehouse to prevent exposure to rain, sun and water erosion;

Do not open the packing box until using. Shelf life depends on visual inspection. It is a long time storage product.

Semi-Rigid Centralizer

Features:

The one-piece semi-rigid bow spring centralizer has a high restoring force while keeping running forces low. Due to the smooth design it is ideal solution for application in which drag forces is the main concern and need to be minimized such as extended reach wells (ERD) and horizontal wells.

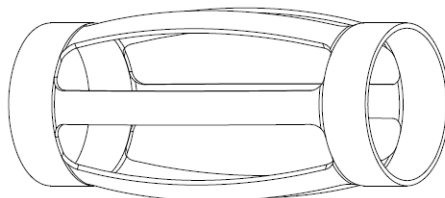
It can easily pass through highly constricted space and come back to its original shape, thus giving excellent standoff in open hole. It is able to minimize gas channelling as it ensures uniform sheet of cement around cased hole.

Applications

- Unconsolidated wells
- Extended reach, horizontal and highly deviated wells
- Shale oil & gas wells
- Vertical and simple wells
- OH Completions, Frac and Swellables
- Sand screen completions

Dimensions:

	Casing size (in)	Hole size (in)	MAX OD (in)	Height (mm)
7 to 8 1/2	7	8 1/2	8 1/2	254 ± 5
8 5/8 to 9 7/8	8 5/8	9 7/8	9 7/8	254 ± 5





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Fixed Rigid Centralizer

Features:

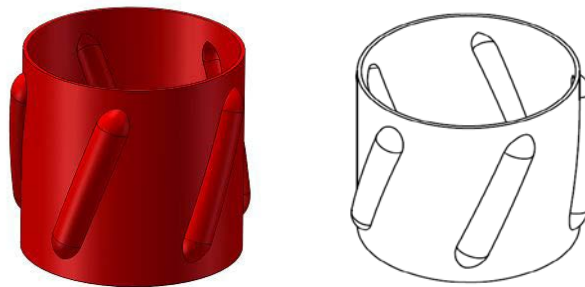
The centralizer features a bearing surface that reduces drag and requires less rotational torque than conventional centralizers.

The hydrodynamic shape of the blades enables optimal mud displacement during the cementing process while minimizing pressure drop and local turbulences across the centralizer.

Applications :

Vertical, inclined, and horizontal wells x Extended-reach wells and wells with high dogleg severity

Dimensions:



	Casing size (in)	Hole size (in)	MAX OD (in)	Height (mm)
7 to 8 1/2	7	8 1/2	8.25	254 ± 5
8 5/8 to 9 7/8	8 5/8	9 7/8	9.625	254 ± 5

Running Instructions:

Rigid centralizers can be allowed to float on the pipe which will allow the Stand-off Band to travel to the leading edge on the coupling and act as a coupling guide.

Storage and Handling Instructions:

Product should be stored in flat, dry warehouse to prevent exposure to rain, sun and water erosion;

Do not open the packing box until use;

Handle with care for heavy subjects;

The product has a shelf life of three years based on visual inspection conditions

Stop Collar

Features:

Stop collars limit the movement of centralizers on the pipe. Stop collars are manufactured to withstand high axial forces and provide the standoff desired. There are various designs for fastening mechanisms.

Set Screw Type Stop Collar

The solid collar set-screw device gives excellent gripping force. It is used where high axial loads are expected.



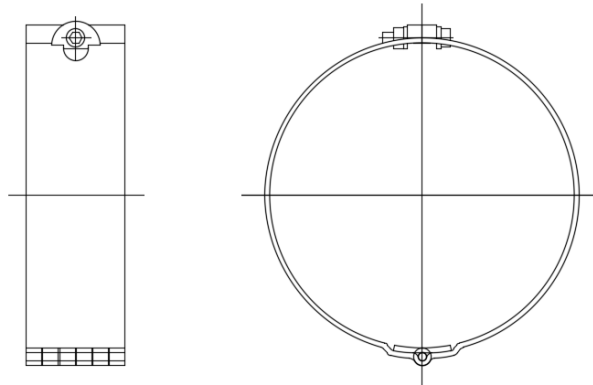
Bolt Type Stop Collar

The stop collar has a cross-bolt design that makes installation quick and easy.



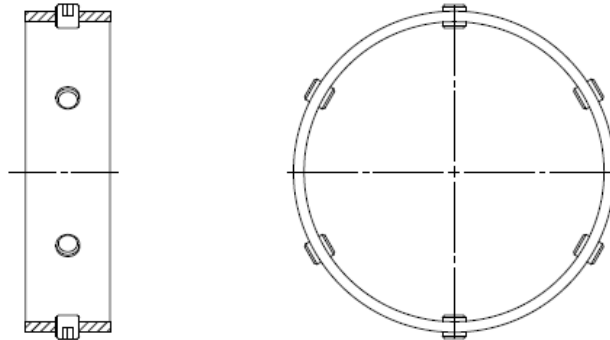
Dimensions:

Bolt Type Stop Collar



Casing size	Hole size (in)	MAX OD (in)	Height(mm)
7	8 1/2	8.46	78
8 5/8	9 7/8	10.15 (due to OD close to arrow's open hole size it is recommended to use set screw stop collar in this case)	78
9 5/8	12 1/4	11.15	78
10 3/4	12 1/4	12.25	78

Set Screw Type Stop Collar



Casing size(in)	Hole size(in)	MAX OD(in)	Qty of screws	Height(mm)
7	8 1/2	7.875	6	40
8 5/8	9 7/8	9.45	8	40
9 5/8	12 1/4	10.43	8	40
10 3/4	12 1/4	11.55	10	50

Running Instructions:

Fastening screw stop ring when use, first set into the casing, and then using a wrench to tighten the screw. Do not over torque .

Storage and handling instructions:

Product should be stored in dry warehouse to prevent exposure to rain, sun and water erosion;

Do not open the packing box until using.

Non-Rotating Surface Release Cementing Plug

Features:

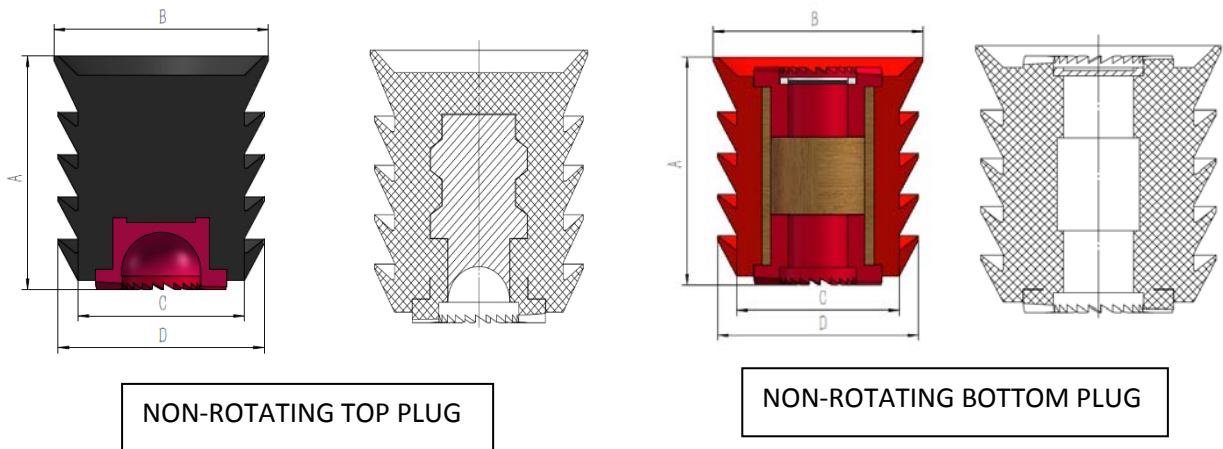
- These series of cementing plug have reinforced locking teeth built into the plugs. The locking teeth lock plugs and the float equipment together to eliminate rotation during drilling to save rig time and cost.
- The plugs are suitable for both PDC and Tricon-bit. Easy to drill out with Bakelite/Resin as core material.
- The polyurethane plug fins offer superior abrasion and wear resistance, providing excellent wiping action, resulting in a clean casing ID after passage.
- Suitable for deep, high-angle wellbores anticipating high displacement and bump pressures as well as shallow vertical wells.
- Suitable for down hole temperature below 120° C
- The bottom plug has a diaphragm rupture rating of 200-500 psi. The pressure rating could be customized according to customer's special requirement.
- The plugs are designed to fit in conventional cementing heads and can be run with any conventional ERA float equipment with a non-rotating plate installed at time of manufacture.



Non-Rotary Top Cementing Plug



Non-Rotary Bottom Cementing Plug

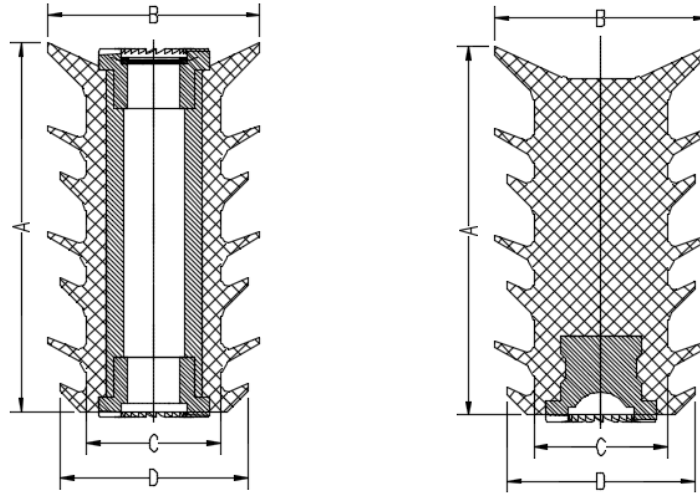


Dimensions:

size	Type	Casing Weight Range	A (mm)	C (mm)	D mm	Max OD (mm)	Burst Pressure MPa	Suitable for Casing with ID in (mm)
7"	Top Plug	20-38	230	130-135	168-173	178-183	200-500psi	5.795-6.456 (147.19-163.98)
	Bottom Plug			130-135				
8 5/8"	Top Plug	24-49	260	168-173	210-214	219-223	200-500psi	7.386-8.097 (187.60-205.66)
	Bottom Plug			168-173				
9 5/8"	Top Plug	32.3-70.3	260	182-187	234-239	244-249	200-500psi	8.001-9.001 (203.23-228.63)
	Bottom Plug			182-187				
10 3/4"	Top Plug	40.5-85.3	298	210-214	262-268	273-279	200-500psi	9.000-10.050 (228.60-255.27)
	Bottom Plug			210-214				

Combination Plug, non-R

Dimensions:



Size	Type	Casing Weight Range(lb/ft)	A(mm)	C (mm)	D (mm)	Max OD mm	Burst pressure Psi	Suitable for casing with ID in (mm)
7"*8 5/8"	Top Plug	7":20-38	335 ± 5	120-125	168-173	210-214		5.795-6.456 (147.19-163.98)
	Bottom Plug	8 5/8":24-49	335 ± 5	120-125	168-173	210-214	200-500psi	7.386-8.097 (187.60-205.66)

According to the well condition Arrow provided, we recommended to use nature rubber as the material of Combination plug

Storage and handling instructions:

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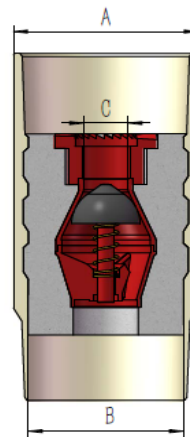
Handle with care for heavy subjects;

The product has a shelf life of two years.

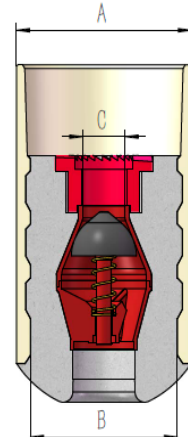
Non- Rotating Float Collar & Float Shoe

Features:

- The float collar and float shoe come with a plastic non-rotating plate to land a multi-tooth non-rotating wiper plug. The non-rotating feature reduces drill-out time.
- Incorporate a spring-loaded check valve, prevent effectively flowing-back of cement from annulus to inner of casing.
- Withstand high back pressure, performances exceed API RP 10F Category IIIC specifications.
- PDC drillable



NON-ROTATING
FLOAT COLLAR



NON-ROTATING
FLOAT SHOE



Dimensions :

Casing size (in)	7	8 5/8	9 5/8	10 3/4	
Weight Range(lb/ft)	23-32	24-40	36-47	40.5-55.5	
Working pressure(psi)	5000	5000	3000	3000	
Temp. rate(°C)	120	120	120	120	
Casing grade	K55	K55	K55	K55	
Casing thread	BTC	BTC	BTC	BTC	
A(in)	7.875	9.625	10.625	11.75	
B(in)	6.25	8.02	8.921	10.05	
C(in)	1.89	2.56	2.56	2.56	
Height (mm)	Float Collar	550±5	550±5	600±5	600±5
	Float Shoe	470±10	470±10	540±10	540±10

Running instructions:

- 1.To ensure trouble-free operation, visually check the float equipment before using it.
2. Float shoe is attached to the downhole end of a casing string. Float collar is 20-30 meters to the bottom of casing string.
3. Monitor and control the running speed of casing string with float collar and float shoe to prevent formation damage.
4. Recommended methods for drilling:
 - 1) Use flat tooth PDC bit for medium-hard formation;
 - 2) Recommended drilling parameters

WOB (T): 6600 to 11000 lb

Rotation speed: 40-75 rpm



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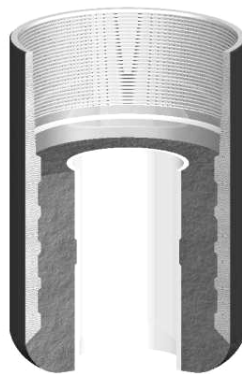
The product has a shelf life of three years.

Guide Shoe

Features:

- Protect the casing string from the impact associated with landing casing on bottom
- Direct casing away from ledges, reducing the chance of sidewall cave-in.
- Help casing pass through narrow, deviated holes and areas with hard shoulders.

Dimensions:



Casing Size		Guide Shoe			
O.D.(in)	Casing Weight (lbs/ft)	O.D.(in)	Thread connection	Nose Type	Height (mm)
7	23.00-38.00	7.874	BTC	CEMENT	320±10

Storage and handling instructions:

Product should be stored in flat, dry warehouse to prevent exposure to rain, sun and water erosion;

Do not open the packing box until use;

Handle with care for heavy subjects;

The product has a shelf life of three years based on visual inspection conditions.

Cementing Basket

Features:

- The cement basket can restrict the downward migration of cementing fluids. They are usually installed above lost circulation zones, under stage tools, or near surface when a top cementing job is planned.
- High-strength metal can withstand excessive hydrostatic pressures exerted by cement columns to prevent formation damage and thereby significantly reduce costs and NPT.
- Flexible, overlapping metal fins aid the basket in forming a bridge in the annulus to prevent cement from falling.



Dimensions:

Casing Size (in)	Hole Size(in)	Max OD (mm)	ID(mm)	Petal Material
7	8 1/2	235 ±5	180±30	Canvas

Running instructions:

Cement basket should be used with relevant PUP joint casing. The lower side should be fixed with pup joint. Cement basket should ideally be run with stop collars on the inside.

1. Locate Cement Basket at desired position in casing string. It is recommended that cement



baskets be grouped at 2 per joint minimum.

2. Install cement basket over casing with Basket fins to be pointed down.

3. Tighten stop collar by an allen wrench.

Storage and handling instructions:

Product should be stored in flat, dry warehouse to prevent exposure to rain, sun and water erosion;

Do not open the packing box until use;

Handle with care for heavy subjects;

The product has a shelf life of three years based on visual inspection conditions.