

The FC Free Flow Nozzle™



REDUCE HAZARDS | REDUCE RISKS | REDUCE ENVIRONMENTAL IMPACT | REDUCE COSTS

Introduction:

The Award Winning and Patented Free Flow Technology™ is an integral part of the FC (Full Cone) Free Flow Nozzle™. The technology allows the nozzle to have a level of reliability that reduces the risk of the nozzle blocking through delivery line contamination to as low as reasonably practicable. The Free Flow Nozzles™ were innovated in 2012 with the Free Flow Adaptor™ and Free Flow Reducing Bush™ (The Free Flow Fittings™) following soon after to protect other industry nozzles from blocking through delivery line contamination.

The technology has been noted to be paving the way for a new level of nozzle compliance where environmental testing considers all eventualities which can impair the nozzles performance during a real-time fire event. The Free Flow Technology™ is allowing companies to introduce “Dry Compliance Testing” to their fire safety systems through the reliability they introduce for when the systems need to go wet during a real time fire incident.

The nozzles are independently certified by Bureau Veritas to API 14G and manufactured in line with ASME B31.3 good engineering practices. Bureau Veritas have independently provided attestations of unique blockage test's, flow tests, pressure tests and profiles to align with engineering designs and calculations.

In 2018 the technology built into the Free Flow Nozzles™ won the Safety Innovation of the year award through Oil & Gas UK in association with Step Change in Safety.

This accolade goes hand in hand with its Patent status where it is recognised as a new and inventive way of introducing an engineered solution to prevent deluge nozzles from blocking where administrative controls have previously only been available.

The logical engineering behind the technology has allowed the “Fail & Fix” method of fire system compliance to be mitigated, where you never get a second chance with a fire as required with the “Fail & Fix” process, the technology allows for a new level of reliability on first time system activation.

Where there is no like for like K-Factor nozzle available we suggest the use of the Free Flow Adaptor™ or Free Flow Reducer™ (The Free Flow Fittings™) to protect other nozzles used to reduce the risk of those nozzles from blocking to ALARP.

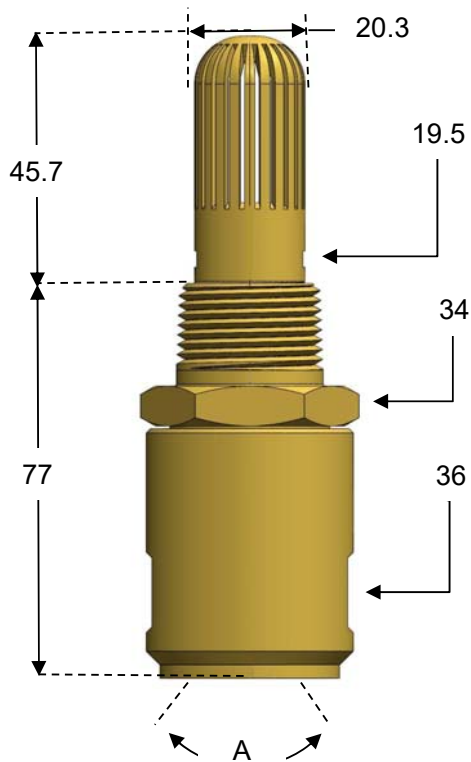
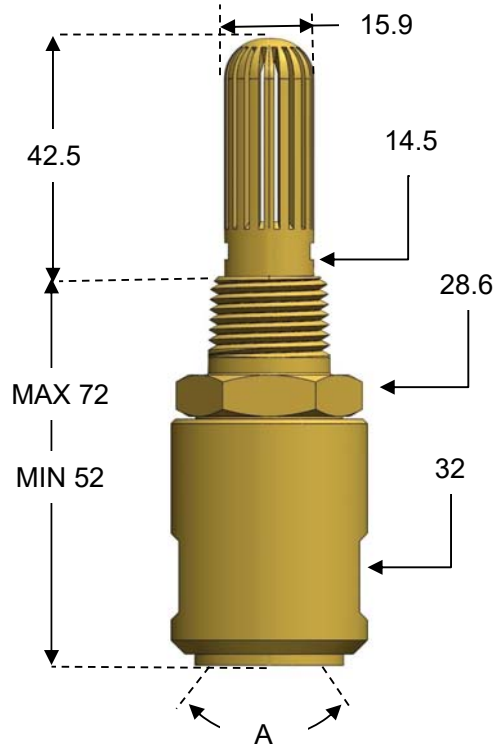
We offer FAT (Factory Acceptance Testing) on all our products where the technology adoption can be achieved through an on-site review or on-line where all stake holders can come together and witness and approve the adoption in a single gathering of those responsible for improving safety and efficiency to an organisation's safety critical systems.

If there is any doubt regarding the selection, installation, operation, and maintenance of the nozzles the purchaser should contact one of our product line champions on support@freeflownozzles.com directly for instruction as required.

NOTE: The Free Flow Nozzles™ are not guaranteed to stop systems from failing but are designed specifically to reduce the risk to as low as reasonably practicable of the nozzles blocking through delivery line contamination and contributing to system failure.

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Nozzle Selection:



CODE	K-Factor Metric	K-Factor Imperial
RDFC055	41.4	2.88
RDFC060	47.5	3.30
RDFC065	54.5	3.76
Angle "A" 90° - 110° - 120° - 125°		
Fitting 0.5" NPT (BSP / BSPT on Request)		
Weight: 327.5g		

Note: On request the Filter Basket can be provided in various lengths (68.1) & sizes. Certificates are available on request for review. Bespoke sizes can be made to order. RDFC040 MIN 52 / RDFC072 MAX 72 10 X Variations available to order for lower and higher K-Factors.

*Bureau Veritas Cert:21OEG30-1814 Rev. 0

*Bureau Veritas ICR: 21ABD10825 Rev. 0

CODE	K-Factor Metric	K-Factor Imperial
RDFC070	69.4	4.82
RDFC075	77.9	5.41
Angle "A" 90° - 110° - 120° - 125°		
Fitting 0.75" NPT (BSP / BSPT on Request)		
Weight: 392.5g		

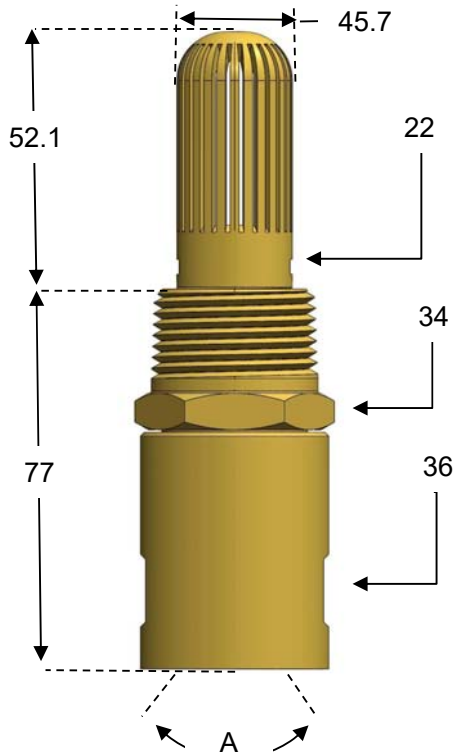
Note: On request the Filter Basket can be provided in various lengths (68.6) & sizes. Certificates are available on request for review. Bespoke sizes can be made to order. RDFC0600 / RDFC0800 Variations available to order for lower and higher K-Factors.

*Bureau Veritas Cert: 21OEG30-1815 Rev. 0

*Bureau Veritas ICR: 21ABD10826 Rev. 0

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Nozzle Selection:



CODE	K-Factor Metric	K-Factor Imperial
RDFC080	88.9	5.01
Angle "A" 90° - 110° - 120° - 125°		
Fitting 1.0" NPT (BSP / BSPT on Request)		
Weight: 495.5g		

Note: On request the Filter Basket can be provided in various lengths (66.0) & sizes. Certificates are available on request for review. Bespoke sizes can be made to order. RDFC0600 / RDFC0800 Variations available to order for lower and higher K-Factors.

*Bureau Veritas Cert: 21OEG30-1816 Rev.0

*Bureau Veritas ICR: 21ABD10827 Rev. 0

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RDFC055 (D) Distance from nozzle position fixed angle

Fixed Angle Position

Spray Angle	0°	D	W	45°	D	W	Profile Notes
	90°	3.2m	5.0m	90°	3.0m	5.0m	All profiles have been noted at 4.1 bar in still conditions and will vary in relation to increased pressure.
	125°	2.1m	5.6m	125°	1.5m	5.6m	

Approx. Dims

RDFC060 (D) Distance from nozzle position fixed angle

Fixed Angle Position

Spray Angle	0°	D	W	45°	D	W	Profile Notes
	90°	3.2m	5.1m	90°	3.1m	5.1m	All profiles have been noted at 4.1 bar in still conditions and will vary in relation to increased pressure.
	125°	2.2m	5.7m	125°	1.6m	5.7m	

Approx. Dims

RDFC065 (D) Distance from nozzle position fixed angle

Fixed Angle Position

Spray Angle	0°	D	W	45°	D	W	Profile Notes
	90°	3.2m	5.2m	90°	3.2m	5.2m	All profiles have been noted at 4.1 bar in still conditions and will vary in relation to increased pressure.
	125°	2.3m	5.8m	125°	1.7m	5.8m	

Approx. Dims

RDFC070 (D) Distance from nozzle position fixed angle

Fixed Angle Position

Spray Angle	0°	D	W	45°	D	W	Profile Notes
	90°	3.2m	5.3m	90°	3.3m	5.3m	All profiles have been noted at 4.1 bar in still conditions and will vary in relation to increased pressure.
	125°	2.4m	5.9m	125°	1.8m	5.9m	

Approx. Dims

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RDFC075 (D) Distance from nozzle position fixed angle

Fixed Angle Position

Spray Angle	0°	D	W	45°	D	W	Profile Notes	
	90°	3.2m	5.4m	90°	3.4m	5.3m		All profiles have been noted at 4.1 bar in still conditions and will vary in relation to increased pressure.
	125°	2.5m	5.8m	125°	1.9m	5.9m		

Approx. Dims

RDFC080 (D) Distance from nozzle position fixed angle

Fixed Angle Position

Spray Angle	0°	D	W	45°	D	W	Profile Notes	
	90°	3.2m	5.5m	90°	3.5m	5.3m		All profiles have been noted at 4.1 bar in still conditions and will vary in relation to increased pressure.
	125°	2.6m	5.9m	125°	1.9m	5.9m		

Approx. Dims



RDFC0800 90°



RDFC0800 90° @ 45°

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Nozzle Selection:

The design of individual safety systems can vary considerably as can the purpose, characteristics, cause, and hazards associated with them. All designs should be performed by experienced designers competent at a level to ensure all safety and performance parameters are achieved to the codes and standards noted along with any local authority requirements.

It is the duty of the purchaser to ensure that the systems where the Free Flow Nozzles™ are utilised are operated, designed, commissioned, serviced, and maintained in line with API 14G / NFPA standards at all times and recorded as such.

If there is any doubt regarding the selection, installation, and operation of the FC Free Flow Nozzles™ the purchaser should contact support@freeflownozzles.com directly or call on +44 (0) 1224 749420 or +44(0)7971 024214 for instruction as required. With all technologies competency is paramount on product selection, with over nine years lessons learned in-house with the technology we suggest all product selection go through our product line champion to avoid the purchaser utilising or purchasing the wrong products for their intended use.

We are also able to provide on-site FAT (Factory Acceptance Test) on profile array and blockage performance to enable a validation case study where the Regulator, ICP, Technical Authority and Installation Company who may witness either on site or live on-line before purchase. This FAT can then be used as part of the safety case for the intended system and its predicted service and maintenance regime. We also suggest the installation team participate in such activities to enable an efficient installation for when the products are delivered on-site.

The FC Free Flow Nozzle™ is manufactured as a 0.5" & 0.75" NPT nozzle which can also be produced in 1.0" NPT with a BSP / BSPT thread on request. It can be manufactured to achieve bespoke design parameters specific to the design application of the system it is to be used in.

The nozzle is primarily used for heat suppression, dust prevention, escape route protection and bush fire protection.

It is advised that the profile will change with a reduced width and have an increased throw distance with pressure above 10 bar. The profile is Full Cone 360° with no distortion ensuring full coverage of the designated area of protection may be achieved. We suggest where more than one nozzle is used that they are located 1.5m apart to enable a cross over of profile to build protection depth. (Design and application dependant)

The blockage test Ref Certs: 21OEG30-1814 Rev. 0, 21OEG30-1815 Rev. 0 & 21OEG30-1816 Rev.0 showed an average of below 10% flow reduction where 25g of contamination was forced directly into the nozzle filter. Notably it takes less than 5g of contamination to fail existing nozzles with or without screens. Additionally, we have recorded a single particle the size of an industry standard nozzles exit orifices to impair or fail its performance.

The risk of the nozzle failing through delivery line contamination is greatly reduced to as low as reasonably practicable with the integration of the Free Flow Nozzle™ Technology.

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General Design Information:

Independently Certified by Bureau Veritas, all certificates can be reviewed on request.

Certification No:

RDFC055 - RDFC060 - RDFC065

*Bureau Veritas Cert:21OEG30-1814 Rev. 0 *Bureau Veritas ICR: 21ABD10825 Rev. 0

RDFC070 - RDFC075

*Bureau Veritas Cert: 21OEG30-1815 Rev. 0 *Bureau Veritas ICR: 21ABD10826 Rev. 0

RDFC080

*Bureau Veritas Cert: 21OEG30-1816 Rev.0 *Bureau Veritas ICR: 21ABD10827 Rev. 0

Performance Maximum design working pressure:	16 barg
Criteria Design working pressure:	1.6 - 16 barg
Design test pressure:	24 barg
Service temperature range:	-10 °C to + 200 °C
Service:	Standard (Sea Water) *Foam Proven

Materials:

- (1) Gun Metal (LG2): Yield \geq 110 MPa; Tensile \geq 230 MPa
- (2) Brass (CW602N): Yield \geq 120 MPa; Tensile \geq 280 MPa
- (3) Stainless Steel (303): Yield \geq 190 MPa; Tensile \geq 500 MPa
- (4) Aluminium Bronze (CA104): Yield \geq 400 MPa; Tensile \geq 600 MPa
- (5) Super Duplex (S32760): Yield \geq 530 MPa; Tensile \geq 730 MPa

Additional materials can be used on special request.

Design references:

ASME B31.3: 2020
API RP 14G: 14th Edition: 2007

NOTE:

The above design information has been reviewed against the specified design references. As a result, BUREAU VERITAS considers that equipment manufactured to this design will satisfy the specified performance criteria.

Consequently, this certificate is considered to contribute towards a duty holder's obligation for the verification of the equipment's design under the requirements of the following regulations and / or associated guidance:

SI-913 (1996) The Offshore Installations and Wells (Design and Construction, etc.) Regulations
SI-2306 (1998) The Provision and Use of Work Equipment Regulations (PUWER)

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Installation:

As noted, it is important to select the correct product for the operation, use and installation which is solely the responsibility of the purchaser. It is also important that the products are installed by a competent person to reduce the risk of damage and improper connection to the system.

Never force the filter into a connection as this may damage and impair the nozzle performance. Inspect all connections and ensure the connection where the nozzle is to be placed is free from obstruction and debris with a clear path into the flow path of the pipe.

If an aging asset or existing system, ensure the delivery lines have been flushed and inspected with condition recorded in writing and visually prior to installation. In a new system we suggest a full system flush prior to fitting installation to remove any installation contamination which may be left with-in the flow lines. Again, we advise the condition to be recorded both in writing and visually.

We would suggest the following pipe fitting guidelines be followed for the NPT threaded fittings.

STEP 1 Inspect port and fitting to ensure that both are free of contaminants and excessive burrs and nicks, we recommend all thread connection be re-dressed on ageing assets.

STEP 2 Apply a stripe of an anaerobic liquid pipe sealant around the male threads leaving the first two threads uncovered. If no liquid sealant is available, wrap Teflon tape 1-1/2 turns in a clockwise direction, from the pipe end, leaving the first two threads uncovered.

CAUTION: Teflon tape and some pipe sealants are destructive to hydraulic components. Always use extreme caution and follow manufacturer's recommendations for proper application of any sealant to prevent contamination. Never allow tape on slots.

STEP 3 Screw finger tight into the port ensuring no distortion on the slotted section of the adaptor, a free turn must be achieved with the circulation flow area.

STEP 4 Wrench tighten the fitting to the correct Turns Past Finger Tight position (See following table). When installing elbows or tees, consider final orientation position as to not exceed the recommended TPFT. A properly assembled fittings total thread engagement should be 3.5 to 6 turns

CAUTION: Do not over tighten and never back of an installed pipe fitting to achieve proper alignment. Loosening installed pipe fittings will corrupt the seal and contribute to leakage and failure. Torque installation of pipe fittings is not a recommended practice. Thread taper and quality, different port and fitting materials, plating thickness and types, varying thread sealants, orientation, and other factors reduce the reliability of a torqued connection. If torque installation is required, refer to the following table for suggested torque values.

Fitting Size	Dash Size	Turns Past Finger Tight	Torque ft/lbs (Steel)	Torque ft/lbs (Brass)
0.50"-NPT	-08	1.5 - 3	54	7-14
0.75"-NPT	-12	1.5 - 3	78	10-20
1.00"-NPT	-16	1 - 2.5	112	20-30

Higher levels of torque may distort the fitting and cause leakage and damage.

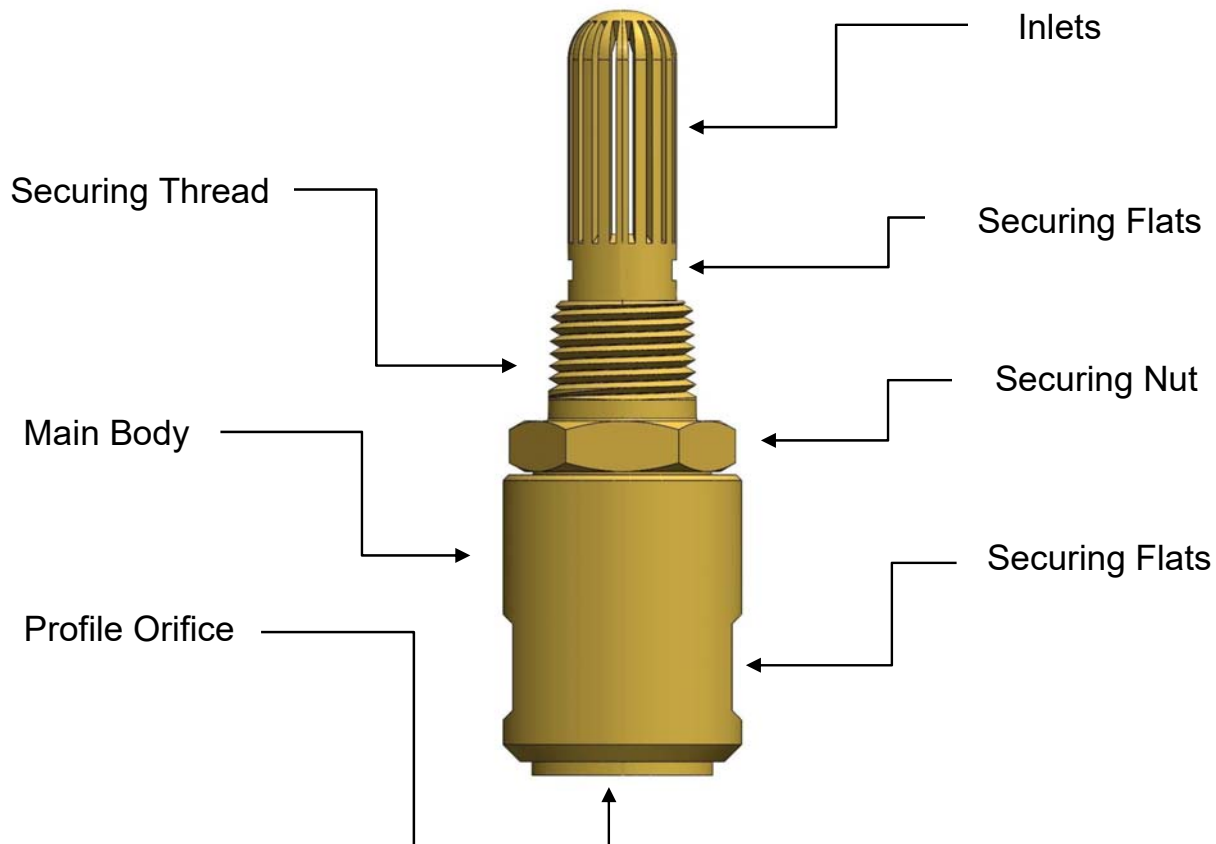
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Maintenance:

The maintenance of the Free Flow Nozzles™ should not be confused with the maintenance of the system in which they are placed, these are two very different requirements.

We would however suggest an annual “Dry Compliance” regime be implemented with a 5 yearly wet test to be complete in line with the duty holders or local authorities’ specific compliance testing rules and standards for systems which use the Free Flow Fittings™

When the nozzles are removed by a competent person for servicing the following should be applied.



- Remove Nozzle and inspect all inlets
- Record condition and clean with a soft wire brush until free from any contamination
- If Damaged Replace
- Inspect and clean all securing threads with a soft wire brush
- Inspect and Clean Profile Orifice
- If Damaged Replace
- Re-dress where applicable and make ready for re-installation

NOTE: Training can be provided on-site or on-line to assist the maintenance team when conducting all operations, a competent trained operator should always be used for testing and maintenance activities. We suggest all locations where heavy debris is found are recorded as “Bad Actor” locations to assist with annual “Dry Testing” and a predictive service and maintenance plan.

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Ordering Guidance:

There are Six FC Free Flow Nozzles™ available with the option of Six K-Factors and Four Profile Orifice Angles. (However bespoke nozzles can be manufactured on request)

For ordering Quote, the Nozzle Part Number e.g., RDFC065 with the preferred angle (90° - 110° - 120° - 125°) along with the material of choice.

Example:

100 x RDFC065 - 110° Al Bronze

To receive a quote, contact support@freeflownozzles.com

To best understand the technology, we would suggest a Lunch and Learn with the noted product line champion either on-site in Aberdeen or on-line where applicable.

If purchasers are available to visit the Aberdeen facility a full demonstration of the nozzles performance can be complete which will include a blockage test in both clear and galvanized pipe where we encourage potential clients to take along any type or level of delivery line contamination inherent to the area or system where the nozzles will be used.

Live fire demonstrations with water & foam are also available on special request:



Come visit us or give us a call to hear about the Free Flow Technologies™ and how they are paving the way for a new fire industry compliance standard.

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