EXPLOSION RELIEF VALVE ASSEMBLY (ERVA)

Product Patent Application No: 202421067488

EXPLOSION RELIEF VALVE ASSEMBLY (ERVA) is a Spray systems protective device which keeps Spray system intact and operating at the shell of Tank even though Part of the system is blown off with the roof of protected tank. Blowing of tank could be due to tank itself on fire or tank in the vicinity on fire. In the event of Fire, to avoid the complete wreckage of Tank filled with Petroleum raw material, interim or final product, generally, these Tanks are designed with Frangible Roofs as per National and International Standards which are applicable for Design, fabrication, and erection of Tanks.

Frangible Joints between the Roof and Shell of Tank allow roof to get expanded and subsequently to blown off to avoid the explosion in the event of fire.

ERVA installed between Spray system piping leading to tank roof from the Tank shell, allows part of Spray system to Blow off with the Tank roof without Damaging upstream side Part of spray system at Tank shell.

While Introducing ERVA in the spray system, it is important to ensure that Pressure Range defined for Spray system is maintained from Apex to bottom most water Sprayer. Hence limiting Pressure loss in the ERVA is essential.

Agni Rakshak (P) Ltd (ARPL) Thane, with its decades of experience in Designing Fire Prevention, Detection and Protection systems have designed and manufactured the ERVA. ERVA is tested at Fluid Control Research Institute (FCRI), Kerala which is under Ministry of Heavy Engineering, Govt. of India.

FEATURES	APPLICATIONS
• *SIMPLE DESIGN* • *EASY CONSTRUCTION* • *LOW CHANCES OF FAILURE* • *LOW MAINTENANCE* • *EASY TO RESET* • *SUITABLE FOR ANY KIND OF HAZARD*	• *CONICAL ROOF TANKS (VERTICAL)*

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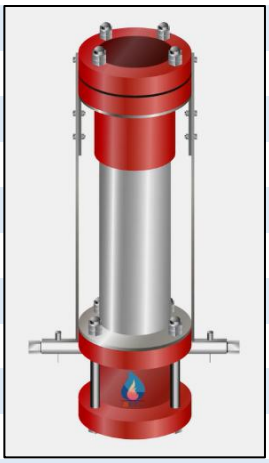
TECHNICAL SPECIFICATIONS

TECHNICAL DATA	SPECIFICATION
Sizes	50NB (2”), 65 NB (2.5”), 80 NB (3”), 80x65 (3”x2.5”)100 NB (4”), 100x80 (4”x3”)
Type	Post Expansion Blow off and shut off
Application	Fire Water Cooling System at Fixed Roof Tanks as per IS:15325
Materials of Construction (MOC)	
A) Auto Operating Stop Valve	
Valve Body	CS ASTM A 216 GR WCB
Flappers (Discs)	AISI SS 410
Seat Ring	AISI SS 410+13%Cr at Facing
B) Release Mechanism (RM)	
Valve Seat Holding Plunger	SS-304
Short & Long Cylinder	SS-304
Plunger Holding Pin	SS-316
C) Expansion Joint	
Outer Pipe	SS SMLS Pipe
Flange at downstream of FCV	CS as per ANSI B16.5, Screwed on type.
KEY TECHNICAL PARAMETERS	
Expansion Initiation Force	664.8 Kgf (6.52 Kilo Newton)
Maximum Expansion	220 mm± 10mm
Maximum Permissible Flow	2.5” (65 NB) = 1000 LPM 3” (80 NB) = 1500 LPM 4” (100 NB) = 2000 LPM
Operating Pressure (Normal Condition)	Max. 3.5 Bar
INSTALLATION & FINISH DETAILS	
Installation Location and Positioning	Slightly below Curb Angle level of Tank, in Vertical Position.
End Connections	Flanged Ends (for 3” & 4” size) and Screwed ends (for 2.5” Size)
Surface Finish (For Main Equipment)	Itch Primer with Red Colour Paint (RAL 3000) except SS parts
CERTIFICATION	
FCRI Certification	For Testing and calibration of pressure Drop across the auto operating stop valve of ERVA.



REQUIREMENT OF ERVA

As per recommendation by Bureau of Indian Standard (BIS) - 15325 for ‘DESIGN AND INSTALLATION OF FIXED AUTOMATIC HIGH & MEDIUM VELOCITY WATER SPRAY SYSTEM – CODE OF PRACTICE’, explosion relief valve assembly need to be provided in firefighting water spray / cooling system for

vertical tanks and vessels. As per IS:15325, various firefighting spray system measures are currently implemented for various areas and equipment in the industry.

Further IS:15325 states that “the conical/flat roof shall be protected by water spray system. For this purpose, sprayers shall be connected through an explosion relief valve assembly which enables sprayer piping on the top of the vessels to be blown off in the event of an explosion without obstructing the sprayers cooling the vertical sides.”

Generally, for any vertical tank protected by fixed Fire Water Spray System (FWSS), sprayers are open type nozzles which direct a specific amount of water at a specific pressure and a specific angle on the tank. These sprayers are placed on the tank roof as well as tank sides or shell. The explosion resistant or explosion relief valve assembly (ERVA) is a part of this fixed water spray system. Before the explosion of tank, tank roof is blown-off, the explosion resistant valve assembly prevents disruption of complete spray system by keeping the FWSS at the tank shell intact when the spray system on the roof top is blown-off with the tank roof.

The FWSS contains sprayer piping network surrounded to the tank shell in the form of ring and also on the roof of the tank. This ring piping at the tank shell and the piping on the tank roof is fed by a main vertical pipe called the riser. This riser is like the backbone of the FWSS piping.

In case of fire in the tank or in the vicinity, the tank roof may expand (without being blown off) due to the tremendous pressure generated inside the tank. This will disturb the Riser (which is attached to the surface as well as roof of the tank) and may crack at the weakest point in the riser thereby causing leakages in the water flowing through the spray system pipe and the sprayers. Either there will be no water coming out of the sprayers or the water may be dripping from the sprayers thereby making the system ineffective.

If the fire heat generated continues to rise, at a certain point the roof will reach its ultimate limit of expansion before giving up from the shell at the frangible joint. The roof will get blown-off and a part of FWSS mounted on roof also will blow off with the tank roof. This results in complete FWSS disruption and redundancy of the spraying and cooling system.

To avoid above situations, there is a need to design the equipment, as part of Fire Water Spray System (FWSS), which will prevent the disruption and redundancy of the spraying and cooling system. This equipment can be installed on the riser where the tank shell and the roof are bifurcated. It will work in tandem with the behavior of tank during the eventuality.

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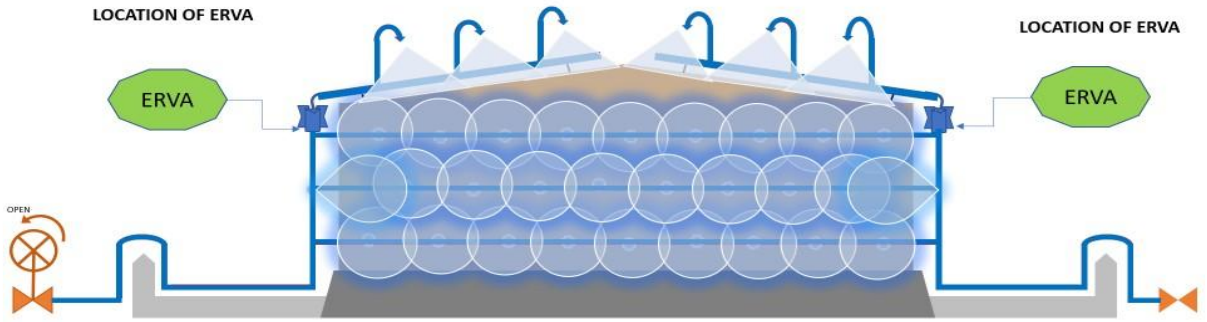
ERVA APPLICATION – How does it Work?

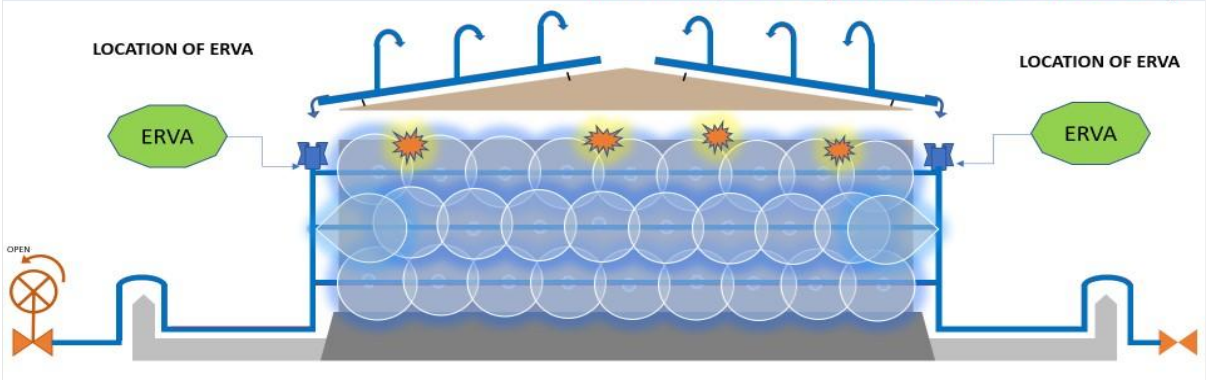


Above image of Spray system at Tank indicates Spray Nozzles at Tank shell, roof, and ERVA

Expansion Joint is fitted at the downstream side of the Auto operating stop valve which Allows to expand the ERVA in tandem with the expansion of tank roof without affecting the pressure and water flow at Tank shell and tank roof.

Release Mechanism will get activated with blowing of Roof. As Tank roof Blows off, it releases the Dual Plates seat of FCV to move to Valve seat and tighten its grip on the valve seat using the pressure of water, thereby not allowing the water flow to proceed to downstream side of FCV.

At the downstream of FCV, Part of expansion Joint will get blown off with roof, and balance part will remain dry of water.



Animated picture showing Water Spray system post roof blow off condition.

POST OPERATION RESETTING AND REQUIREMENT OF SPARES

In case Tank's Roof is blown off, it will take away Part of Expansion Joint, i.e. standard pipe with screwed on Flange fixed on that pipe and GI wire rope with Eye bolts fixed on this flange at both ends. Hence no special spares are required for post operation correction & resetting of ERVA. Resetting FCV with the releasing Mechanism is also a simple task without involving any hot work at site.

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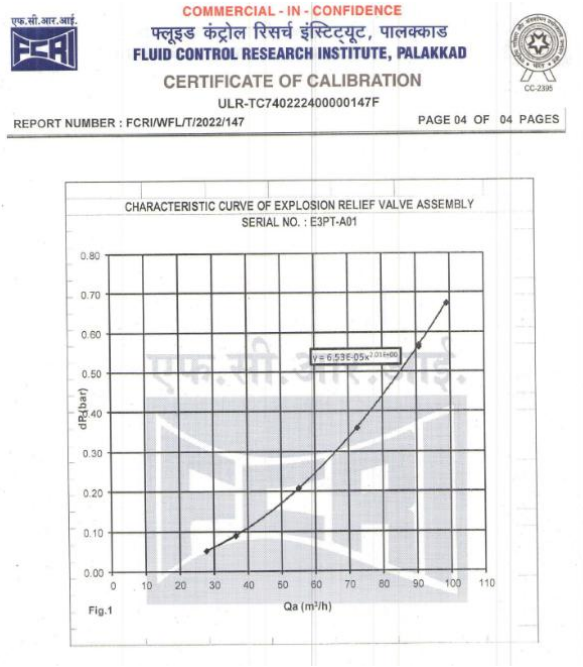
FCRI Certificate



COMMERCIAL - IN - CONFIDENCE

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FLUID CONTROL RESEARCH INSTITUTE, PALAKKAD

CERTIFICATE OF CALIBRATION

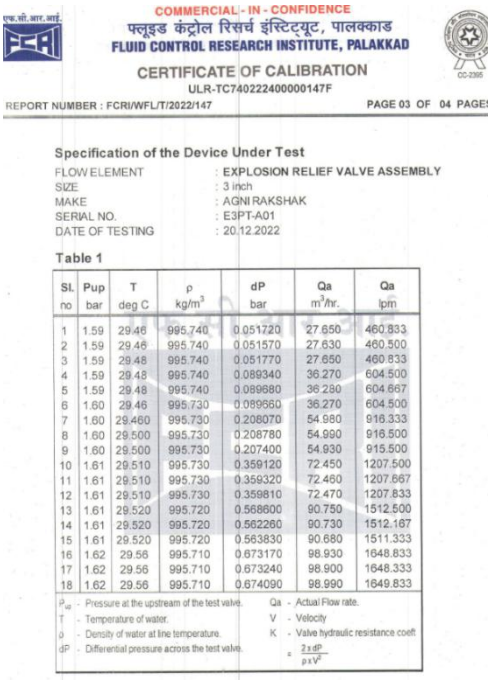
ULR-TC740222400000147F

REPORT NUMBER : FCRI/WFL/T/2022/147 PAGE 04 OF 04 PAGES

CHARACTERISTIC CURVE OF EXPLOSION RELIEF VALVE ASSEMBLY

SERIAL NO. : E3PT-A01

Fig.1



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Specification of the Device Under Test

FLOW ELEMENT : EXPLOSION RELIEF VALVE ASSEMBLY
SIZE : 3 inch
MAKE : AGNI RAKSHAK
SERIAL NO. : E3PT-A01
DATE OF TESTING : 20.12.2022

Table 1

Sl. no	Pup bar	T deg C	ρ kg/m³	dP bar	Qa m³/hr.	Qa lpm
1	1.59	29.46	995.740	0.051720	27.650	460.833
2	1.59	29.46	995.740	0.051570	27.630	460.500
3	1.59	29.48	995.740	0.051770	27.650	460.833
4	1.59	29.48	995.740	0.089340	36.270	604.500
5	1.59	29.48	995.740	0.089680	36.290	604.667
6	1.60	29.46	995.730	0.089660	36.270	604.500
7	1.60	29.460	995.730	0.208070	54.980	916.333
8	1.60	29.500	995.730	0.208780	54.990	916.500
9	1.60	29.500	995.730	0.207400	54.930	915.500
10	1.61	29.510	995.730	0.359120	72.450	1207.500
11	1.61	29.510	995.730	0.359320	72.460	1207.667
12	1.61	29.510	995.730	0.359810	72.470	1207.833
13	1.61	29.520	995.720	0.568600	90.750	1512.500
14	1.61	29.520	995.720	0.562260	90.730	1512.167
15	1.61	29.520	995.720	0.563830	90.680	1511.333
16	1.62	29.56	995.710	0.673170	98.930	1648.833
17	1.62	29.56	995.710	0.673240	98.900	1648.333
18	1.62	29.56	995.710	0.674090	98.990	1649.833

P_{up} - Pressure at the upstream of the test valve. Qa - Actual Flow rate.
T - Temperature of water. V - Velocity
ρ - Density of water at line temperature. K - Valve hydraulic resistance coeff
dP - Differential pressure across the test valve. $K = \frac{2 \times dP}{\rho \times V^2}$

For more details about the product contact:

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GSTN: 27AAOCA2325B1Z2; CIN: U74120MH2016PTC273273; Udyam Registration: UDYAM-MH-33-0015412