

# WATER-POWERED BLOWER TYPE HIGH-EXPANSION FOAM GENERATORS

MODEL: SDG 3000, SDG 10000, SDG 21000

## SYSTEM OVERVIEW

High-expansion foam systems are recommended to be used to protect hazards located indoors, under partial shelter, or completely outdoors. However most effective in indoor spaces where they are used to submerge a fire and exclude the air needed to sustain combustion. Provisions must be planned to compensate for winds and other effects of weather if the system planned for outdoor. High expansion foam generators are typically mounted as part of a fixed system in the roof space of the protected area.

High expansion systems aim to create foam at an expansion ratio in excess of 200:1. The reduced water content of the foam means that less water damage is inflicted on the items being protected within the site. In addition, speed with which the system can totally submerge the hazard in foam is a key measurement of performance and can dictate the number of foam generators required to protect the site. High expansion foam works very well for three-dimensional fires. Its functionality is based on 4 principles: smothering the insulation of the combustibles from air, penetrating effect of the water/foam solution and cooling.

## DESCRIPTION

SHIELD Water-powered high expansion foam Generators is Blower type shall be fixed type, SHIELD High Expansion Foam Generator requires no other source of power such as electricity or gasoline engines. They are powered by the foam solution driving a hydraulic (water) motor or turbine the expansion of foam solution is achieved by spraying the solution onto a nylon net/stainless steel screen, then an air stream created by the fan attached to the motor blows air through the screen to produce a mass of foam bubbles. The continuous flow of the foam solution plus the movement of air through the screen will produce large volumes of finished foam. When used with SHIELD 2% High-Expansion Foam Concentrate, these generators are capable of producing finished foam with expansion ratios from 354:1 up to 925:1, depending on the model and operating pressure.

## FEATURES

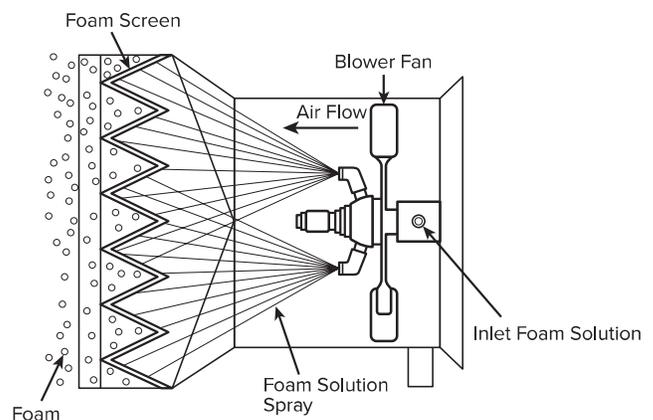
- Water-powered, no electrical power is required
- Foam capacities of up to 595 m<sup>3</sup>/min(21,000 cfm)
- Inherently safe operation for hazardous area use
- Variable expansion
- Smoke extractor options



## APPLICATION

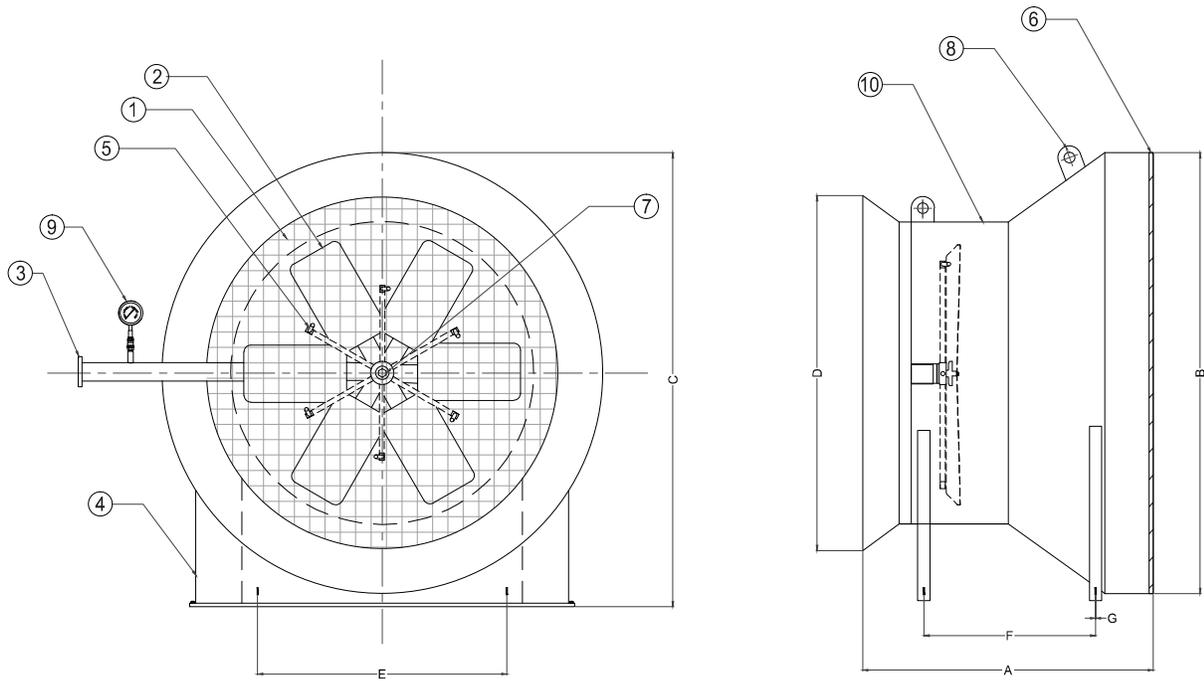
- Oil Refineries & Oil Installations
- Control of Vapor release from toxic/flammable
- Flammable Liquid including Paint Stores
- Cable Ducts & Transformer Rooms
- Ship holds & Engine Rooms.
- Basements & Substations.
- Chemical Stores, Mining
- Liquid spills.
- Petrochemical Plants
- Tyre & Rubber Stores.
- Aircraft Hangars
- Fertilizer Plant

## FOAM GENERATOR COMPONENTS



## MATERIALS OF CONSTRUCTION

Item No	Component	Material	Optional
1	Back Net	Stainless Steel 316	--
2	Fan Assembly	Mild Steel	Stainless Steel 304
3	Flange	Stainless Steel 316	--
4	Body Stand	Stainless Steel 316	Carbon Steel
5	Nozzle Assembly	Gun Metal	Brass
6	Foam Screen	Stainless Steel 316	--
7	Turbine Assembly	Gun Metal	--
8	Hook To Body	Stainless Steel 316	Carbon Steel
9	Pressure Gauge	Stainless Steel 316	--
10	Generator Body	Stainless Steel 316	Carbon Steel



DIMENSIONS IN MM (± 5%)

Model	A	B	C	D	E	F	G	Weight (kg)	Inlet Flange
SDG 3000	985	800	845	495	300	620	φ18 x 4	75	1"
SDG 10000	1320	1370	1470	1070	600	750	φ18 x 4	100	1½"
SDG 21000	1215	1800	1850	1450	950	770	φ18 x 4	220	2"

## PERFORMANCE DATA

### UL LISTED PERFORMANCE DATA (SD HEFC 2%)

Model	UL Listed Orientation	Inlet Pressure		Flow Rate		Foam Output		* Foam break down constant 'S' cfm/gpm	Expansion Ratio
		psi	bar	GPM	LPM	cfm	cmm		
SDS3000	Horizontal or Vertical	40	2.8	40	150	1800	51	3.3	354:1
		72	5	53	200	2500	71	3.3	390:01
		100	6.9	62	233	3000	85	3.3	395:01
SDG 10000	Horizontal or Vertical	40	2.8	69	261	6000	170	8.2	675:01
		72	5	85	321	8000	227	8.2	743:01
		100	6.9	98	372	10000	283	8.2	799:01
SDG 21000	Horizontal or Vertical	40	2.8	110	417	10000	283	9.5	707:01
		72	5	142	535	14000	396	9.5	754:01
		100	6.9	175	659	21000	595	9.5	925:01

\*Sprinkler type, upright or pendent nominal k factor 5.6

### PAINTING

SHIELD generator model body and fan assembly are painted. *(optional without painting)*

### APPROVALS AND CERTIFICATIONS

SHIELD High-Expansion Foam Generators are UL Listed for use with the SD-HEFC 2% High-Expansion Foam Concentrate.

### OPERATION AND MAINTENANCE

Refer to the SHIELD High-Expansion Foam Generator Operation and Maintenance Manual for detailed procedures on installation, operation, and maintenance. A printed copy of this manual is included with every generator.

### ORDERING INFORMATION

When ordering a High Expansion Foam Generator, please provide the following information:

- Volume of risk to be protected.
- Available residual water flow and pressure
- Method of proportioning required.
- Material of construction.
- Type of Inlet connection.

## SYSTEM CALCULATION

The minimum rate of discharge or total generator capacity shall be calculated from the following formula:

$$R = \left( \frac{V}{T} + R_s \right) \times C_N \times C_L$$

Where:

- R = rate of discharge in m<sup>3</sup>/min (ft<sup>3</sup>/min)
- V = submergence volume in m<sup>3</sup> (ft<sup>3</sup>)
- S = submergence time in minutes
- T = Submergence Time in minutes
- R<sub>s</sub> = rate of foam breakdown by sprinklers in m<sup>3</sup>/min (ft<sup>3</sup>/min)
- C<sub>N</sub> = compensation for normal foam shrinkage
- C<sub>L</sub> = compensation for leakage

The factor (R<sub>s</sub>) for compensation for breakdown by sprinkler discharge shall be determined by the following formula:

$$R_s = S \times Q$$

Where:

- S = foam breakdown in m<sup>3</sup>/min · L/min (ft<sup>3</sup>/min · GPM) of sprinkler discharge.  
S shall be 0.0748 m<sup>3</sup>/min · L/min (10 ft<sup>3</sup>/min · GPM)
- Q = estimated total discharge from maximum number of sprinklers expected to operate in L/min (GPM)

The factor (C<sub>N</sub>) for compensation for normal foam shrinkage shall be 1.15, which is an empirical factor based on average reduction in foam quantity from solution drainage, fire, wetting of surfaces, absorbency of stock, and so forth.

The factor (C<sub>L</sub>) for compensation for loss of foam due to leakage around doors and windows and through unclosable openings shall be determined by the design engineer after evaluation of the structure. This factor shall not be permitted to be less than 1.0 even for a structure completely tight below the design filling depth. This factor shall be permitted to be as high as 1.2 for a building with all openings normally closed, depending on foam expansion ratio, sprinkler operation, and foam depth.

Maximum Submergence Time for High-Expansion Foam Measured from Start of Foam Discharge in Minutes shall be considered as per NFPA

**FOR TOTAL FLOODING**  
(NON-SPRINKLERED)

**BUILDING**

100ft × 40ft × 10ft high.

**CONSTRUCTION**

Light bar joist, steel roof, Masonry walls with all openings closable.

**OCCUPANCY**

Vertically stacked unbanded rolled kraft paper (high density combustible, submergence time shall be 5 minutes as per NFPA 11, Table 6.12.7.1)

**CALCULATION WITHOUT SPRINKLERS**

$$R = (V/T) \times C_N \times C_L$$

R = Rate of Discharge in cfm

V = Submergence Volume in ft<sup>3</sup>

T = Submergence Time in minutes

C<sub>N</sub> = Compensation for normal shrinkage (1.15)

C<sub>L</sub> = Compensation for leakage  
1.0, no leakage  
1.2, moderate leakage

$$\begin{aligned} R &= (40,000 \text{ ft}^3/5 \text{ min}) \times 1.15 \times 1 \\ &= 8,000 \times 1.15 \times 1 \\ &= 9,200 \text{ cfm required} \end{aligned}$$

9,200 cfm / 1800 cfm per SDG 3000 @ 2.8 bar  
= 5.11 generators

Therefore, use Six SDG 3000 generators at 1800 cfm each

**FOR LOCAL APPLICATION**  
(SPRINKLERED)

**BUILDING**

100ft × 50ft × 30ft high.

**CONSTRUCTION**

Light bar joist, steel roof, Masonry walls with all openings closable.

**OCCUPANCY**

Vertically stacked unbanded rolled kraft paper 25ft high (high density combustible, submergence time shall be 5 minutes as per NFPA 11, Table 6.12.7.1)

**SPRINKLER PROTECTION**

Wet system 10ft × 10ft spacing. 0.25 GPM/ft<sup>2</sup> density.

**ASSUME**

Fire will open 40 sprinkler heads. Foam leakage around closed doors, drains, and so forth, hence C<sub>L</sub> = 1.2.

**CALCULATION WITHOUT SPRINKLERS**

$$R = (V/T + R_s) \times C_N \times C_L$$

R = Rate of Discharge in cfm

S = Rate of foam breakdown by sprinklers  
10 cfm. GPM

Q = estimated total discharge from maximum number of sprinklers.  
= Number of heads × area/head × density  
= 40 × (10 × 10) × 0.25 = 1000 GPM

$$R_s = S \times Q = 10 \times 1000 = 10,000 \text{ ft}^3/\text{min}$$

T = Submergence Time in minutes

C<sub>N</sub> = Compensation for normal shrinkage (1.5)

C<sub>L</sub> = Compensation for leakage

$$\text{Foam Depth:} = 25 \times 1.1 = 27.5 \text{ ft}$$

(This depth is greater than minimum cover of 2ft.)

V = Submergence Volume in ft<sup>3</sup>  
= 100 × 50 × 27.5 = 135,700

$$\begin{aligned} R &= (135,700 \text{ ft}^3 / 5 \text{ min} + 10,000) \times 1.15 \times 1.2 \\ &= 51,253.2 \text{ required} \end{aligned}$$

51,254 cfm / 10,000 cfm per SDG 21000 @ 2.8 bar  
= 5.12 generators

Therefore, use Six SG 21000 generators at 10,000 cfm each

# HIGH EXPANSION GENERATOR

MODEL: SD-HEFG-100P, SD-HEFG-FRP-300P, SD-HEFG-SS-300P, SD-HEFG-SSI-300P

## SPECIAL FEATURES:

- Highly reliable design, does not require a strainer at the foam solution inlet
- Very high output of foam
- Portable & Fixed
- Easy installation with units capable of being mounted in the horizontal or vertical position
- No outside source of power required- only the pressurized foam solution
- By pass arrangement for specific models
- In-built foam induction for portable
- Units will operate with foam solution pressures as low as 2.1 kg/cm<sup>2</sup> (30 psi).
- Smoke extraction

## DESCRIPTION

The SD-HEFG, High Expansion Foam Generators are powered by a water turbine. These are designed to expand the foam solution with Expansion ratios up to 1000:1, depending upon the solution flow rate and the water pressure. However, the optimum expansion ratio is in the range of 500:1 up to 700:1. The High Expansion Foam Generator requires no other source of power such as electricity or gasoline engines. They are powered by the foam solution driving a hydraulic (water) motor or turbine. The expansion of foam solution is achieved by spraying the solution onto a nylon net/stainless steel screen, then an air stream created by the fan attached to the motor blows air through the screen to produce a mass of foam bubbles. The continuous flow of the foam solution plus the movement of air through the screen will produce large volumes of finished foam. Portable systems are having its own proportioning system whereas the fixed systems are to be used with the fixed proportioning system.

A pressure gauge is provided at the foam solution inlet. The design of the SD-HEFG-500L is such that a single nozzle with a large diameter orifice sprays foam solution across the aeration screen. The incorporation of this nozzle prevents clogging, thereby ensuring an uninterrupted foam discharge, almost irrespective of the water quality.

## APPLICATIONS:

- Oil Refineries & Oil Installations
- Chemical Stores.
- Control of Vapour release from toxic/flammable liquid spills.
- Petrochemical Plants
- Tyre & Rubber Stores.
- Shipholds & Engine Rooms.
- Flammable Liquid including Paint Stores
- Aircraft Hangars

- Cable Ducts & Transformer Rooms
- Fertilizer Plant
- Basements & Substations.
- Mining

## FOAM CLEANING

After the area has been secured, the foam can be cleared by simply hand sweeping or blowing off by compressed air minimizing eventual water damage.



## MATERIAL OF CONSTRUCTION

Model	Material		
	SDEFG-100P*	SD-HEFG-FRP-300P	SD-HEFG-SS-300P & SD-HEFG-SSI-300P
Body/Shell	SS304	FRP	SS304
Nozzle	GM	GM	GM
Foam Screen	KF	KF	SS304
Coupling	GM/Al.Alloy/SS	GM/Al.Alloy/SS	GM/Al.Alloy/SS
Flange**	Optional	Optional	Optional
Piping	SS 304	SS 304	SS 304
Inductor	GM	GM	GM
Fan	Al. Alloy	Al. Alloy	Al. Alloy
Turbine Assembly	Gun Metal	Gun Metal	Gun Metal

**\*OPTIONAL**

- i) These models have the smoke extraction facility with smoke duct of 7.5 meter, MOC-synthetic leather.
- ii) Foam duct of length 10 meter made of polythene (disposable)

\*\*Flange is provided on request

## PERFORMANCE DATA

Model	Type	Inlet Pressure, bar	Water Flow, LPM	Foam Production cmm	Foam Expansion Ratio	
Standard Performance Data (with 3% Concentrate)						
SD-HEFG-100P	Portable	3.5	135	34	250	
		5.0	165	83	500	
		7.0	200	120	600	
SD-HEFG-FRP-300P	Portable with System Induction					
By-Pass System <b>CLOSED</b>		4.0	180	77	425	
		5.5	210	121	575	
		7.0	235	165	700	
		10.0	280	224	800	
By-Pass System <b>OPEN</b>			<b>Total</b>	<b>By-pass</b>		
		4.0	200	50	68	450
		5.5	220	55	112	675
		7.0	255	65	162	850
		10.0	290	80	210	1000
SD-HEFG-SSI-300P	Portable with System Induction					
By-Pass System <b>CLOSED</b>		4.0	195	78	400	
		5.5	225	124	550	
		7.0	250	168	670	
		10.0	290	226	780	
By-Pass System <b>OPEN</b>			<b>Total</b>	<b>By-pass</b>		
		4.0	215	53	85	430
		5.5	235	58	118	670
		7.0	268	69	159	800
		10.0	305	85	211	960
SD-HEFG-SS-300P	Portable without System Induction	5.0	260	169	650	
		6.0	290	206	710	
		7.0	320	256	800	

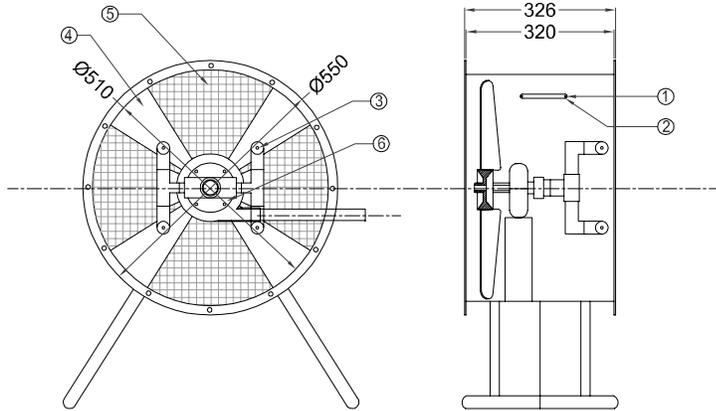
SD-HEFG-FRP-300P & SD-HEFG-SSI-300P with system induction comes with by-pass facility, normally used for smoke extraction purpose and control over foam production with varying pressure.

In line with shield policy for continuous product development, shield has the right to change specifications without prior notice.

**ORDERING INFORMATION**

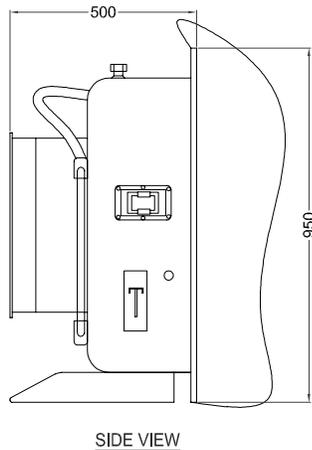
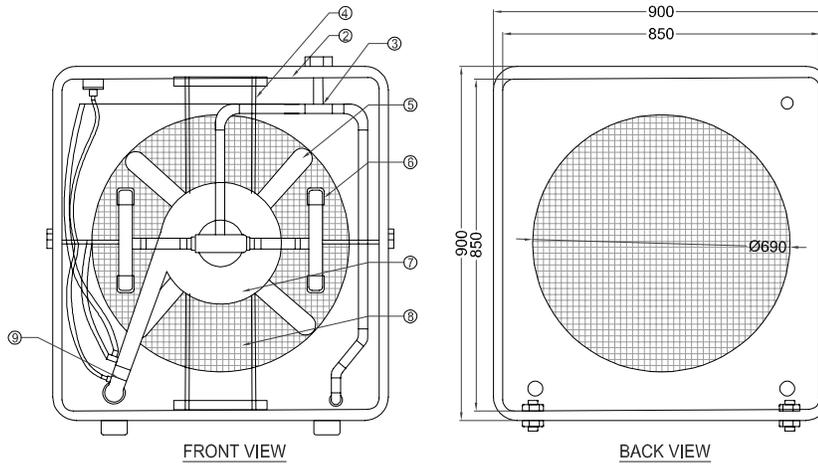
Generator Model	Description	Color	Weight (kg)
SD-HEFG-100P	Portable with system induction	Red	35
SD-HEFG-FRP-300P	Portable with system induction	Red/Yellow	65
SD-HEFG-SSI-300P	Portable with system induction	Red	95
SD-HEFG-SS-300P	Portable without induction	Red	90

**SD-HEFG-100P**



Part No.	Part Name
1	Body/Shell
2	Lifting Handle
3	Nozzle
4	Fan
5	Back Net
6	Turbine

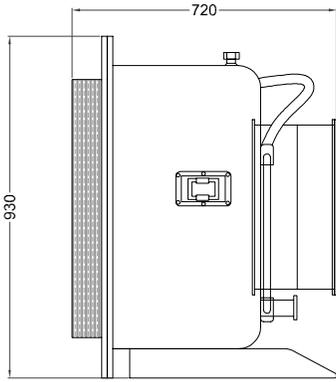
**SD-HEFG-FRP-300P**



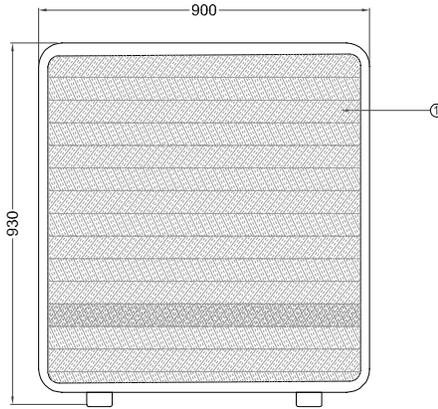
Part No.	Part Name
1	Knitted fabrics foam screen
2	Body
3	Pickup tube
4	Frame
5	Fan
6	Nozzle
7	Turbine
8	Back net
9	Pipe line assembly with inductor

*In line with shield policy for continuous product development, shield has the right to change specifications without prior notice.*

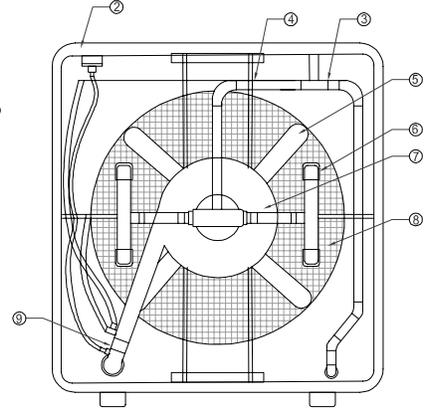
**SD-HEFG-SSI-300P WITH SYSTEM INDUCTION**



SIDE VIEW

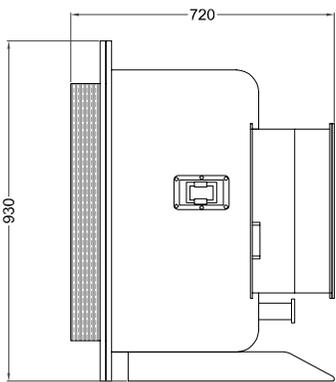


FRONT VIEW

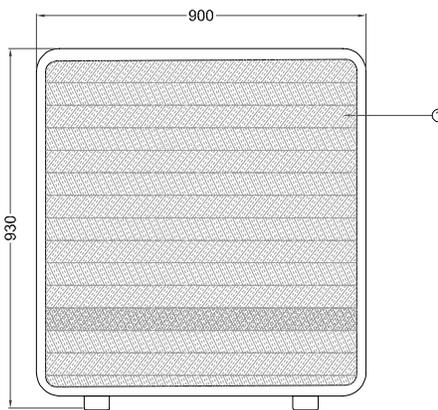


- |                |                                    |
|----------------|------------------------------------|
| 1. Foam screen | 6. Nozzle                          |
| 2. Body        | 7. Turbine                         |
| 3. Pickup tube | 8. Back net                        |
| 4. Frame       | 9. Pipeline assembly with inductor |
| 5. Fan         |                                    |

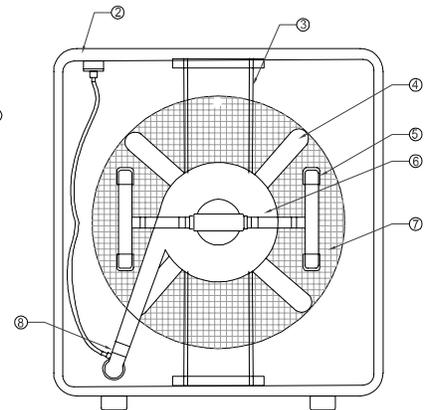
**SD-HEFG-SS-300P WITHOUT INDUCTION**



SIDE VIEW



FRONT VIEW



- |                |                                    |
|----------------|------------------------------------|
| 1. Foam screen | 5. Nozzle                          |
| 2. Body        | 6. Turbine                         |
| 3. Frame       | 7. Back net                        |
| 4. Fan         | 8. Pipeline assembly with inductor |

# HIGH EXPANSION FOAM GENERATOR

MODEL: SD-6000F

## DESCRIPTION

SHIELD Foam Generator is a high expansion foam generator designed to expand foam solution more than 700 times. It is a reliable high expansion discharge device powered by water turbine. No other source of power such as electricity or gasoline engine is needed.

The expansion of the foam solution is achieved by spraying the solution and forcing the air stream generated by the fan through the foam making net. This produces a mass of foam bubbles as it gets out through the mesh. The forced air fed by the fan of water turbine and the continuous flow of foam solution sprayed by highly efficient spray nozzles results in the generation of large volumes of foam.

## APPLICATION

SHIELD Foam Generators can be used to protect the following typical hazards.

- Flammable liquid storage areas
- Liquefied natural gas storage and handling areas
- Paper products ware houses
- Hazardous waste storage areas and incineration plants
- Chemical storage areas
- Tire ware houses
- Mining and power stations
- Cable tunnels
- Air craft hangars
- Flammable liquid bottling areas
- Ships' engine rooms and holds
- Cellars, basements and enclosed spaces

## FEATURES

- Can produce well-formed and high quality foam
- No external source of power is required
- More than 700 times foam expansion rate can be achieved
- Covers 3300 CFM at 4 bar inlet pressure
- Foam generator housing constructed of FRP material
- Corrosion resistant pipe work and fittings



## PROPORTIONING

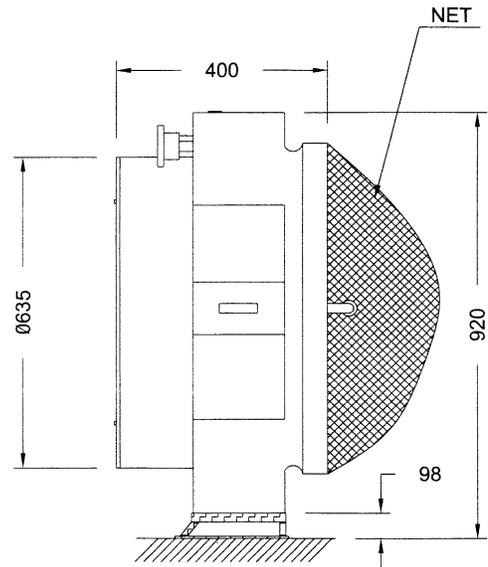
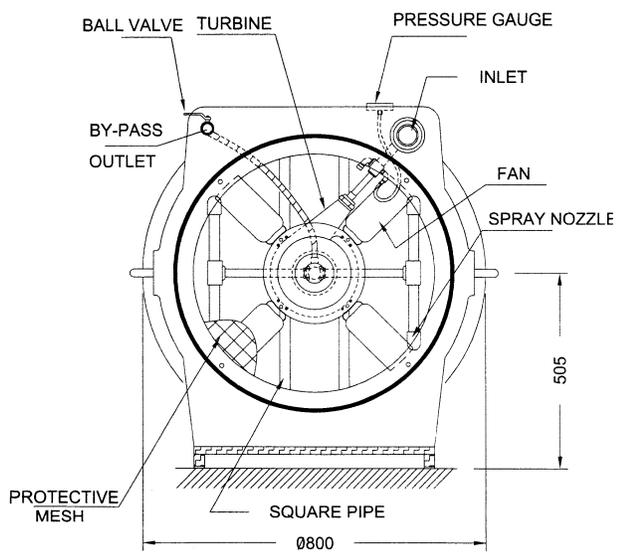
SHIELD Foam Generators can be used along with the following proportioning equipment.

- Fixed or Portable Inductors
- Bladder tank proportioning system
- Foam pump proportioning system

## TECHNICAL DATA

Water Pressure, bar	Discharge Water, LPM	Discharge Foam, CFM	Foam Expansion
4	210	3300	444
7	300	6000	564
10	385	7800	572
Material of Cabinet		FRP	
Inlet Connection		2½" BS Instantaneous	

## DIMENSIONS



# HIGH EXPANSION FOAM GENERATOR

MODEL: SD-31-3

## DESCRIPTION

SHIELD Foam Generator is a high expansion foam generator designed to expand foam solution more than 1000 times. It is a reliable high expansion discharge device powered by water turbine. No other source of power such as electricity or gasoline engine is needed.

Supplied foam by a water turbine all that is needed for operation of foam liquid concentrate and a water supply. A unique by-pass system is installed which allows performance to be maintained when working into high back pressure. By control of the inlet pressure and the by-pass, the type of foam bubble can be varied as shown in the performance data. High Expansion Foam Generator is designed to produce a large capacities of foam bubble up to 100 m3/min at pressure 4 bars. It is also capable of smoke extracting via Polythene bellows type of smoke extracting duct, which is also used for ventilation and removal of foam just after the fire is extinguished.

## APPLICATION

SHIELD Foam Generators can be used to protect the following typical hazards.

- Flammable liquid storage areas
- Liquefied natural gas storage and handling areas
- Paper products ware houses
- Hazardous waste storage areas and incineration plants
- Chemical storage areas
- Tire ware houses
- Mining and power stations
- Cable tunnels
- Air craft hangars
- Flammable liquid bottling areas
- Ships' engine rooms and holds
- Cellars, basements and enclosed spaces

## TECHNICAL DATA

Inlet	2½" NH Female (BS336 Optional)
Flow	180 LPM @ 4 bar
Foam Liquid	AFFF 3% and 6%
Material	Yellow chemically FRP resin
Foam Expansion Ratio	500 ~ 700 times
Induction Rate	4.5 LPM
Smoke Extraction Rate	280 CFM
Measurement	885(W) x 1015(H) x 435 (D)mm



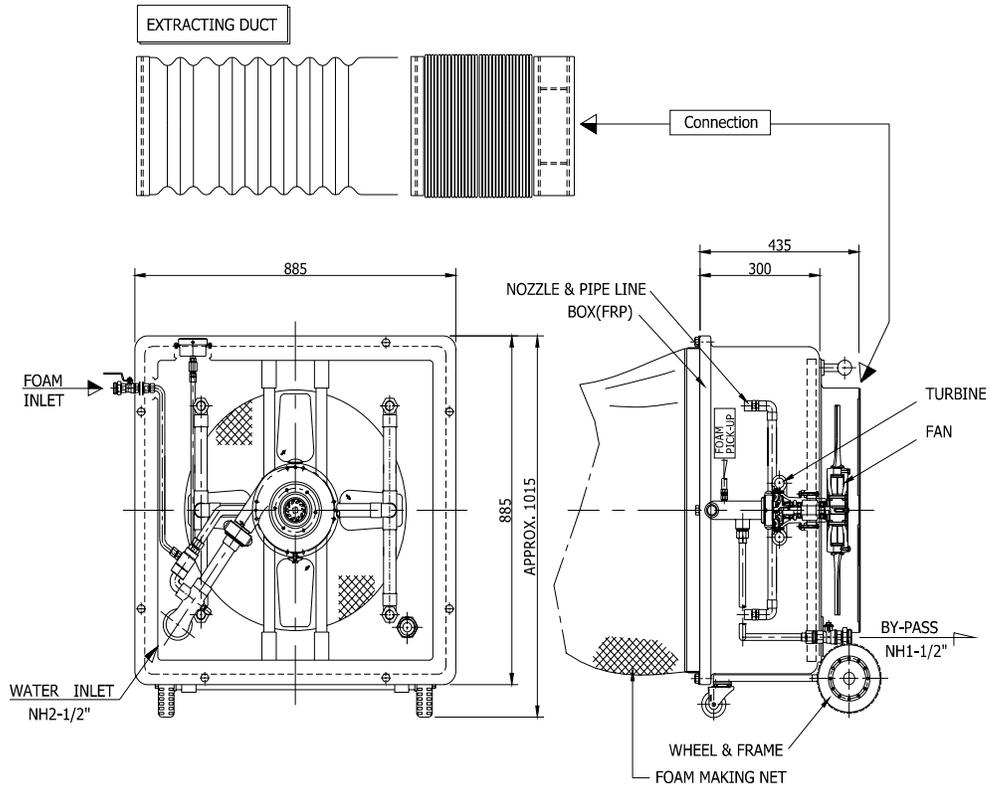
## SMOKE VENTILATION

- Connect the smoke duct to the fan side (opposite of foam bubble outlet)
- Close the two (2) of 1" ball valve which are placed at inside of foam bubble net
- Open the by-pass
- Start smoke extracting

## MATERIAL OF CONSTRUCTION

Water Turbine	Cast Bronze (ASTM C83600)
Pipe Work	Bronze & Copper, Black Epoxy Painted
Foam Spray	Cast Bronze Spray Nozzle, Plated
Carrying Handle	Stainless Steel
Foam Bubble Net	Nylon Woven Mesh
Smoke Extracting Duct	Polythene Bellows (7M. Length)

## DIMENSIONS



## PERFORMANCE CHARACTERISTICS

	Inlet Pressure (bar)	Foam Output (m <sup>3</sup> /min)	Expansion Ratio
By-Pass <b>CLOSED</b>	4	65	500 ~ 700:1
	6	88	
	7	100	
	8	113	
	10	145	
By-Pass <b>OPEN</b>	4	72	800 ~ 1000:1
	6	100	
	7	115	
	8	135	
	10	255	

*\*NOTE: Flow will depend on ambient temperature and quality of foam concentrate used.*

# MINI FOAM GENERATOR

MODEL: SDMG500

## DESCRIPTION

SHIELD Mobile Foam Generator is a fast response medium expansion foam generator designed to expand foam solution into many millions of tiny stable bubbles of foam. No other source of power such as electricity or gasoline engine is needed.

The expansion of the foam solution is achieved by spraying the solution and the air stream created by the fan produce a mass of foam bubbles as it gets out through a mesh. The continuous flow of the foam solution and the movement of the air through the mesh will generate large volumes of foam.

Mobile Foam Generator is suitable for total flooding application in basements, mines, tunnels, cable ducts and warehouses. It is ideally suitable for rapid smoke extraction and positive pressure ventilation.

## APPLICATION

SHIELD Foam Generators can be used to protect the following typical hazards.

- Flammable liquid storage areas
- Liquefied natural gas storage and handling areas
- Paper products ware houses
- Hazardous waste storage areas and incineration plants
- Chemical storage areas
- Tire ware houses
- Mining and power stations
- Cable tunnels
- Air craft hangars
- Flammable liquid bottling areas
- Ships' engine rooms and holds
- Cellars, basements and enclosed spaces



## TECHNICAL DATA

Inlet	2½" BS336 Male
Material of Cabinet	Stainless Steel
Expansion Ratio	260-360
Foam Output	40-94 m <sup>3</sup> /min
Inlet Pressure	2.8-8.4 bar