Engineers Week Seminars, Feb 12, 2013

Introduction to Purge + Pressurization Systems for Equipment Protection in Hazardous Locations

9140 Ravenna Road, Unit #3
Twinsburg, Ohio 44087

Expo Technologies

Purge + Pressurization Specialists

specializes in the protection of electrical equipment for use in Hazardous or Classified Locations

FM APPROVED

CLASSIFIED c UL us

CE

ATEX Ex

IEC IECEx

INMETRO

expo

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  - for USA, Canada and Mexico

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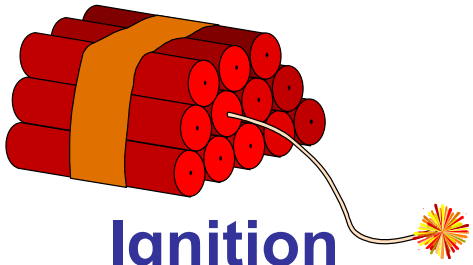
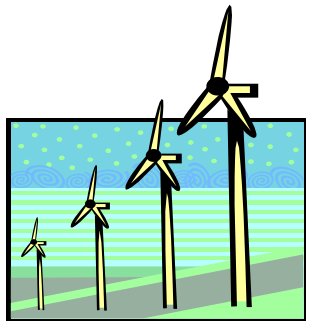
The Ignition Triangle



Ignition

Flammable Substance



Oxygen

Why is there a need for Safety & Protection ?

Contra Costa County, California:

Over 50 serious accidents have been reported in the last 20 years in Chemical Plants, Refineries & Power Facilities, etc.

For further information check out this web page:

http://www.cchealth.org/groups/hazmat/accident_history.php

In 1999 an ISA Report concluded that an
EXPLOSION occurs on
average 1.5 TIMES per month in USA

Results …

Explosion Proof Installation

WHAT DO YOU SEE WRONG?

Hazardous Area Classifications

Hazardous Area Classifications

NEC™

National Electrical Code

(trademark of NFPA, National Fire Protection Association)

www.nfpa.org

Article 500

Defines hazardous area locations into Classes (I, II, and III) and Divisions (1 and 2)

NEC – Article 500

Hazardous Locations -

Class I : Areas where inflammable gases or vapors may be present in sufficient quantities to produce explosive or flammable mixture.

Groups - A Acetylene
B Hydrogen
C Ether
D Gasoline

NEC – Article 500

Hazardous Locations -

Class II : Areas where combustible dusts are present in sufficient quantities to produce explosive or flammable mixture.

Groups - E Metal Dust
F Coal Dust
G Grain

Class III : Areas where ignitable fibers or flyings are present in sufficient quantities to produce explosive or flammable mixture.

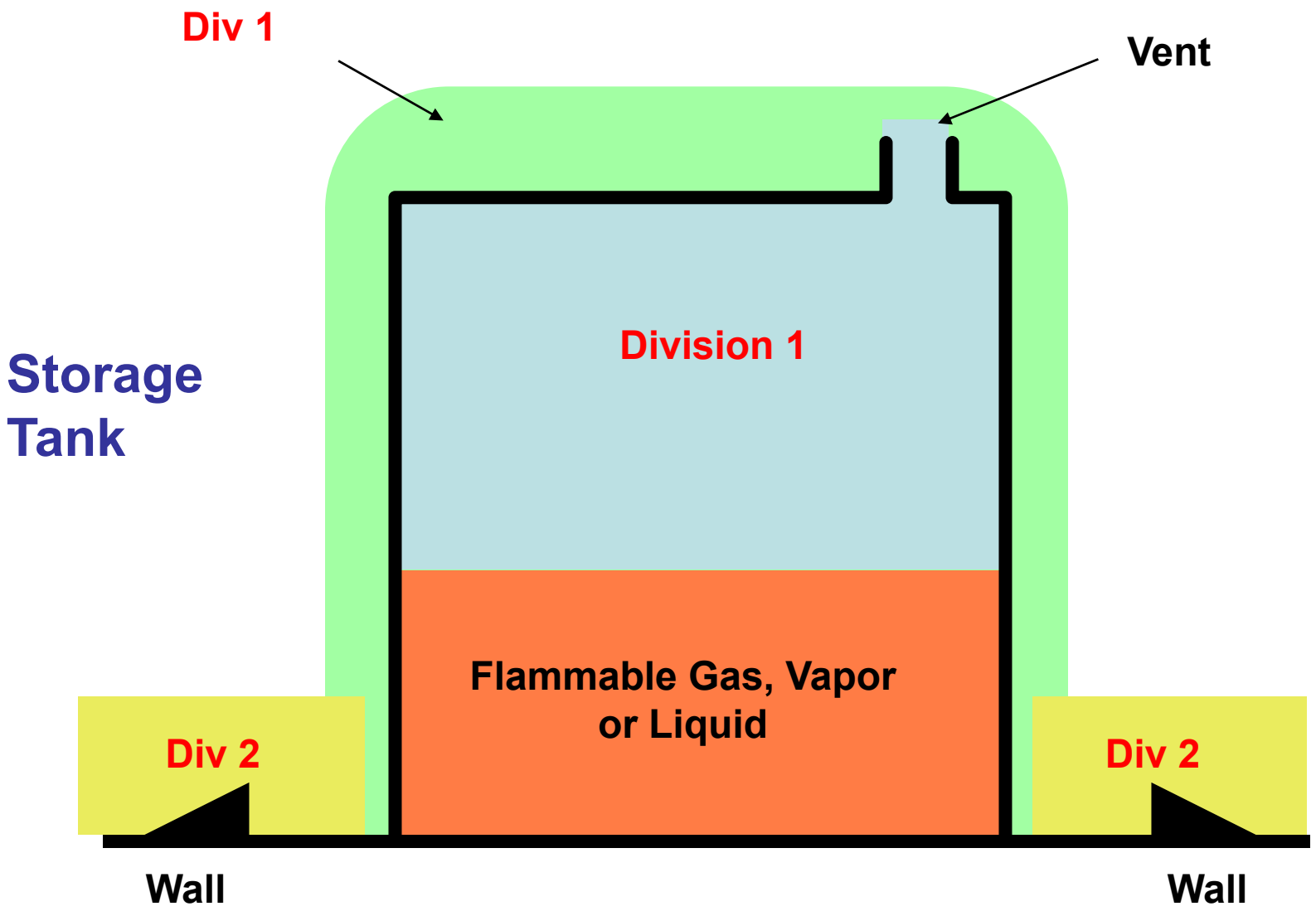
NEC – Article 500

Hazardous Locations -

Division 1 : Areas where the hazardous condition is normally present either continuously or periodically.

Division 2 : Areas where the hazardous condition is present due to accidental rupture, breakage or unusual faulty operation of a closed container or system.

NEC – Article 500 : Divisions



NEC – Article 500

Hazardous Locations -

Temperature Class : Maximum allowable operating temperature for a hazardous area (based on an ambient of 40°C). Also known as 'T' rating.

	Code		Code		Code
450°C (842°F)	T1	200°C (392°F)	T3	100°C (212°F)	T5
300°C (572°F)	T2	180°C (356°F)	T3A	85°C (185°F)	T6
280°C (536°F)	T2A	165°C (329°F)	T3B		
260°C (500°F)	T2B	160°C (320°F)	T3C		
230°C (446°F)	T2C	135°C (275°F)	T4		
215°C (419°F)	T2D	120°C (248°F)	T4A		

Hazardous Area Classifications

IEC

International Electrotechnical Commission

www.iec.ch

Standard 60079

Defines hazardous areas locations into Zone 0, 1 and 2

+ NEC Article 505 adapts IEC 60079 Zone definitions

IEC - Standard 60079

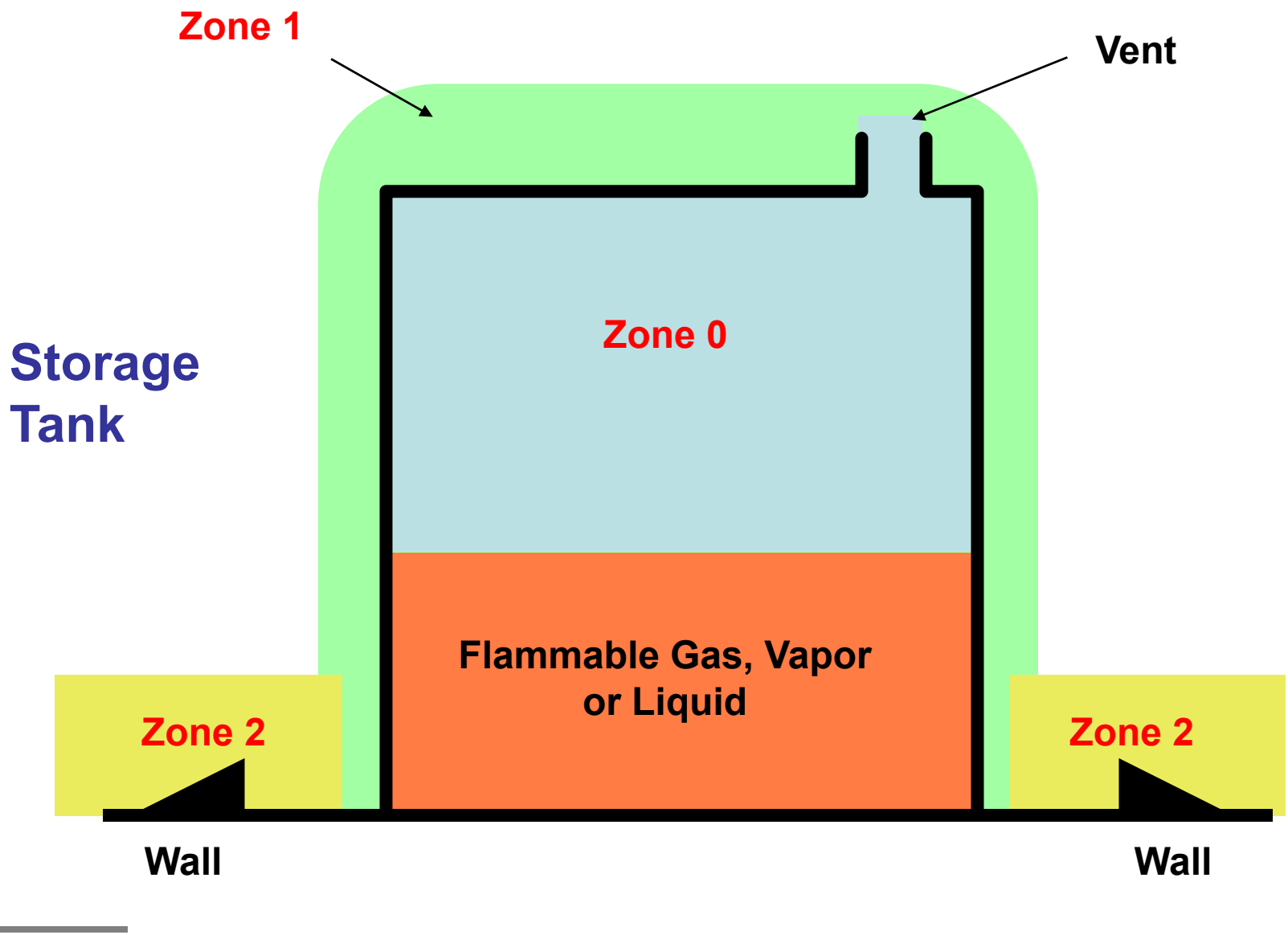
Hazardous Locations -

Zone 0 : Areas in which an explosive atmosphere is continually present or present for long periods of time; typically over 100 hours per year.

Zone 1 : Areas in which an explosive atmosphere is likely to occur during normal operation; typically between 10 and 100 hours per year.

Zone 2 : Areas in which an explosive atmosphere is not likely to occur during normal operation, and if it does occur, will exist only a short period of time; typically less than 10 hours per year.

IEC – Standard 60079 : Zones



IEC - Standard 60079

Hazardous Locations -

Groups : Gases are grouped together based on the amount of energy required to ignite the most explosive mixture of the gas with air.

I – Methane
IIA – Propane
IIB – Ethylene
IIC – Hydrogen

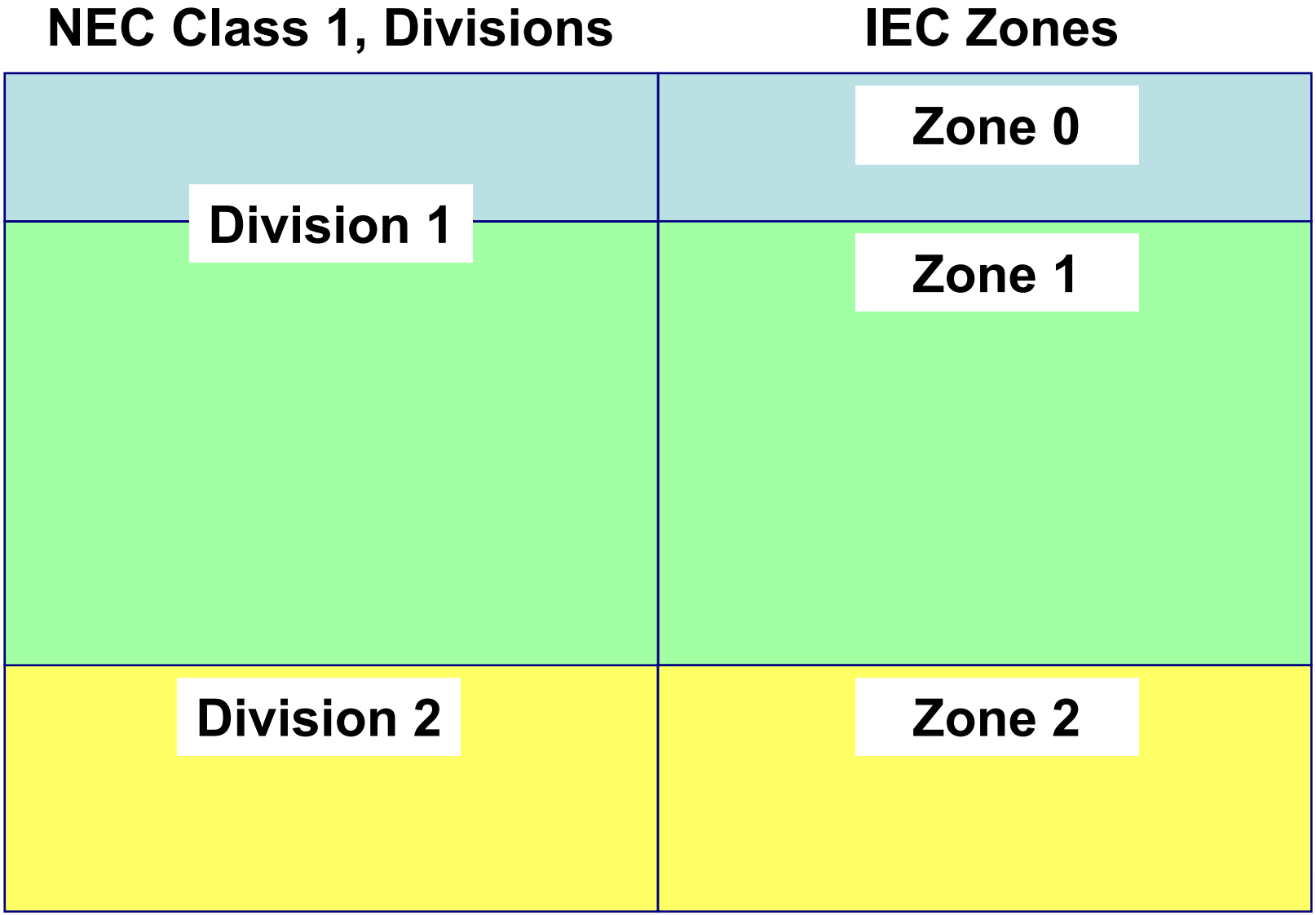
IEC - Standard 60079

Hazardous Locations -

Temperature Class : Maximum allowable operating temperature for a hazardous area (based on an ambient of 40°C). Also known as 'T' rating.

	Code
450°C (842°F)	T1
300°C (572°F)	T2
200°C (392°F)	T3
135°C (275°F)	T4
100°C (212°F)	T5
85°C (185°F)	T6

NEC vs IEC - Comparison



Hazardous Area Classifications

ATEX Directive (94/9/EC)

+ Adopted by European Union (EU) to facilitate free trade among its members.

+ Aligns technical and legal requirements for products to be used in potentially explosive atmospheres.

+ July 1, 2003 – Mandatory for all member countries.

+ Uses IEC 60079 Standard

Protection Methods

Protection Methods : NEC - Article 500

Most common -

+ **Intrinsic Safety (code "IS")**
+ **Explosion Proof (code "XP")**
+ **Purge & Pressurization (code "X, Y, Z")**

+ ***Note:*** **Additional methods are defined**

Protection Methods : IEC – Standard 60079

Most common -

+ **Intrinsic Safety** **(code Ex ‘i’)**
+ **Flameproof** **(code Ex ‘d’)**
+ **Purge & Pressurization** **(code Ex ‘p’)**

+ ***Note:*** **Additional methods are defined**

HazLoc Hand Chart

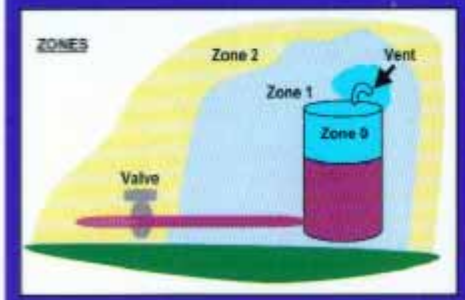
Protection Method	IEC / EN (ATEX)						ATEX
	Ex code	Gas		Ex code	Dust		Category
Intrinsic Safety	ia	60079-11	Zone 0	iaD	61241-11	Zone 20	1
	ib	60079-11	Zone 1	ibD	61241-11	Zone 21	2
	ic	60079-11	Zone 2				3
Flameproof	d	60079-1	Zone 1				2
Enclosure				tD	61241-1	Zone 20,21,22	
Purge & Pressurization	px	60079-2	Zone 1				2
	py	60079-2	Zone 1				2
	pz	60079-2	Zone 2				3
Pressurized				pD	61241-4	Zone 21, 22	
Increased Safety	e	60079-7	Zone 1				2
Encapsulation	ma	60079-18	Zone 0	maD	61241-18	Zone 20	1
	mb	60079-18	Zone 1	mbD	61241-18	Zone 21	2
Oil Immersion	o	60079-6	Zone 1				2
Powder Filled	q	60079-5	Zone 1				2
Non Incendive	nA, nC nL, nR	60079-15	Zone 2				3
Rooms (draft)	p	60079-13	Zone 1				2
Optical Radiation	op ...	60079-28	Zone 0				1
General Requirements		60079-0			61241-0		
Class. of Hazardous Areas		60079-1					
Electrical Installations		60079-14					
Inspection & Maintenance		60079-17					

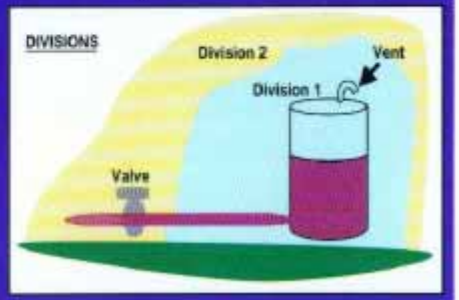
Code	USA (NEC 500) FM & UL	Canada (CEC) CSA	Gas	Dust
IS	FM3610 / UL913	C22.2 No 157	Class I, Div 1	Class II, Div 1
XP	FM3615 / UL1203	C22.2 No 30	Class I, Div 1	Class II, Div 1
	FM3611 / UL1604	C22.2 No 25		Class II, Div 2
Type X	FM3620 / NFPA 496	CSA TIL 13A	Class I, Div 1	Class II, Div 1
Type Y	FM3620 / NFPA 496	CSA TIL 13A	Class I, Div 1	Class II, Div 1
Type Z	FM3620 / NFPA 496	CSA TIL 13A	Class I, Div 2	Class II, Div 2
X, Y, Z	as above			
	UL1604	C22.2 No. 213	Class I, Div 2	
NI	FM3611 / UL1604	C22.2 No. 213	Class I, Div 2	
	NFPA 496			
	NEC 500-3			

The following countries publish the IEC as National Standards with the following prefix in place of IEC: Australia/New Zealand = AS/NZ, Canada = E, USA = ISA
Other countries such as Argentina, Brazil, etc., have adopted the IEC standards.

www.expoworldwide.com

IEC IECEx ATEX FM APPROVED CLASSIFIED cULus CE





FIRST & Only Tri-Certified Range of "Purge & Pressurize" Control Systems
One Design for Global Applications

Expo Technologies Ltd
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sales@expoworldwide.com

www.expoworldwide.com

Expo Technologies Inc
USA Tel: 888-NFPA-496 (Toll Free)
sales.na@expoworldwide.com

Temperature Ratings

Surface Temperature	IEC, EU (Europe) USA (NEC 505)	USA (NEC 500) Canada
450°C (842°F)	T1	T1
300°C (572°F)	T2	T2
280°C (536°F)		T2A
260°C (500°F)		T2B
230°C (446°F)		T2C
215°C (419°F)		T2D
200°C (392°F)	T3	T3
180°C (356°F)		T3A
165°C (329°F)		T3B
160°C (320°F)		T3C
135°C (275°F)	T4	T4
120°C (248°F)		T4A
100°C (212°F)	T5	T5
85°C (185°F)	T6	T6

US NEMA & IP Ratings

NEMA	IP	Abbreviated Description
1	IP20	General purpose indoors, from contact with contents
3	IP55	Dust protection / water jets
3R	IP24	Outdoor, rain, sleet, windblown dust & ice damage
4	IP65	Outdoor, windblown dust, rain, splashing & direct hose, icing
4X	IP65	NEMA 4 plus corrosive agents

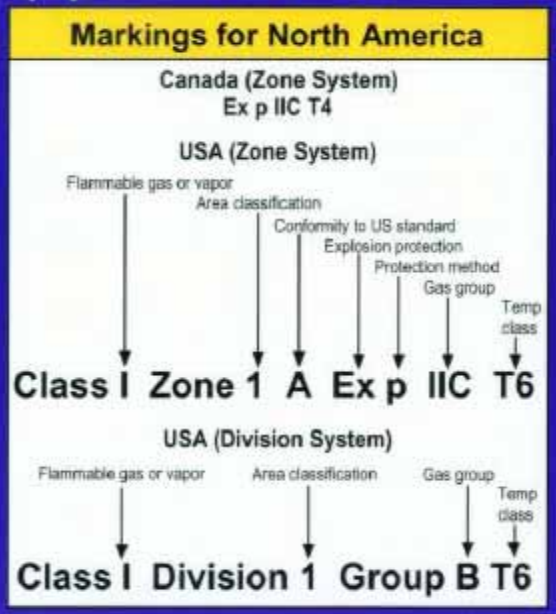
Ingress Protection (IP) Ratings

First Number Protection against solid bodies	Second Number Protection against liquid
0 No Protection	0 No Protection
1 Objects greater than 50mm	1 Vertically dripping water
2 Objects greater than 12mm	2 75° to 90° dripping water
3 Objects greater than 2.5mm	3 Sprayed water
4 Objects greater than 1mm	4 Splashed water
5 Dust-protected	5 Water jets
6 Dust-tight	6 Heavy seas
	7 Temporary immersion
	8 Indefinite immersion

Hazardous Area Equipment Mark

Markings for IEC / EN (ATEX)

Markings for North America



Gas Groupings

Gas, Dust or Fiber	IEC / Europe Canada (CEC)	USA NEC (505)	Canada (CEC) USA NEC(500)
Acetylene	Group IIC	Class I, Group IIC	Class I, Group A
Hydrogen			Class I, Group B
Ethylene	Group IIB	Class I, Group IIB	Class I, Group C
Propane	Group IIA	Class I, Group IIA	Class I, Group D
Methane	Group I *		Not within CEC*/NEC
Metal Dust			Class II, Group E (Div 1 only)
Coal Dust			Class II, Group F
Grain			Class II, Group G
Fibers			Class III

IEC / ATEX Dust

Dust	Temp °C (Cloud)	Temp °C (Layer)
Cellulose	520	410
Coal	380	225
Cocoa Powder	580	480
Flour	490	340
Grain	510	300
Polythene	420	Melts
Sugar	460	435
Tea	510	300

Issue 02-08

Protection Methods

What is …

Purge & Pressurization

Uses air or inert gas to neutralize or remove any flammable mixture entering or being formed in the enclosure.

There are **two** (2) system methods.

- Continuous Flow
- Leakage Compensation

+ An initial purge to remove the potential internal gas is required before power can be applied.

CF vs. LC Systems ?……

CF = Continuous Flow
- 0.4 SCFM to 8.0 SCFM flows through panel

- Flow Rate depends on Orifice Plate Size selected

- Air flow is “continuous”

LC = Leakage Compensation
- Enclosure is Purged 4 volume changes

- After 4 volume changes, air flow rate is minimized

- Air is then used as needed for LC

- Pressure maintained at >0.2 in WC (NFPA 496 = .1”)

Definition of Purging

WHAT IS PURGING ???

It is defined as the process of supplying an enclosure with a protective gas, at a sufficient flow and positive pressure to reduce the concentration of any flammable gas or vapor initially present to an acceptable level.

FACT: 20 Microjoules of Energy is generated by a "Falling Quarter."

How Much Pressure ???

Max Pressure = 4 inches of Water Column

(This is the setting of the Relief Valve)

Note: 1” of WC = 0.03613 PSI @ 39.2°F,

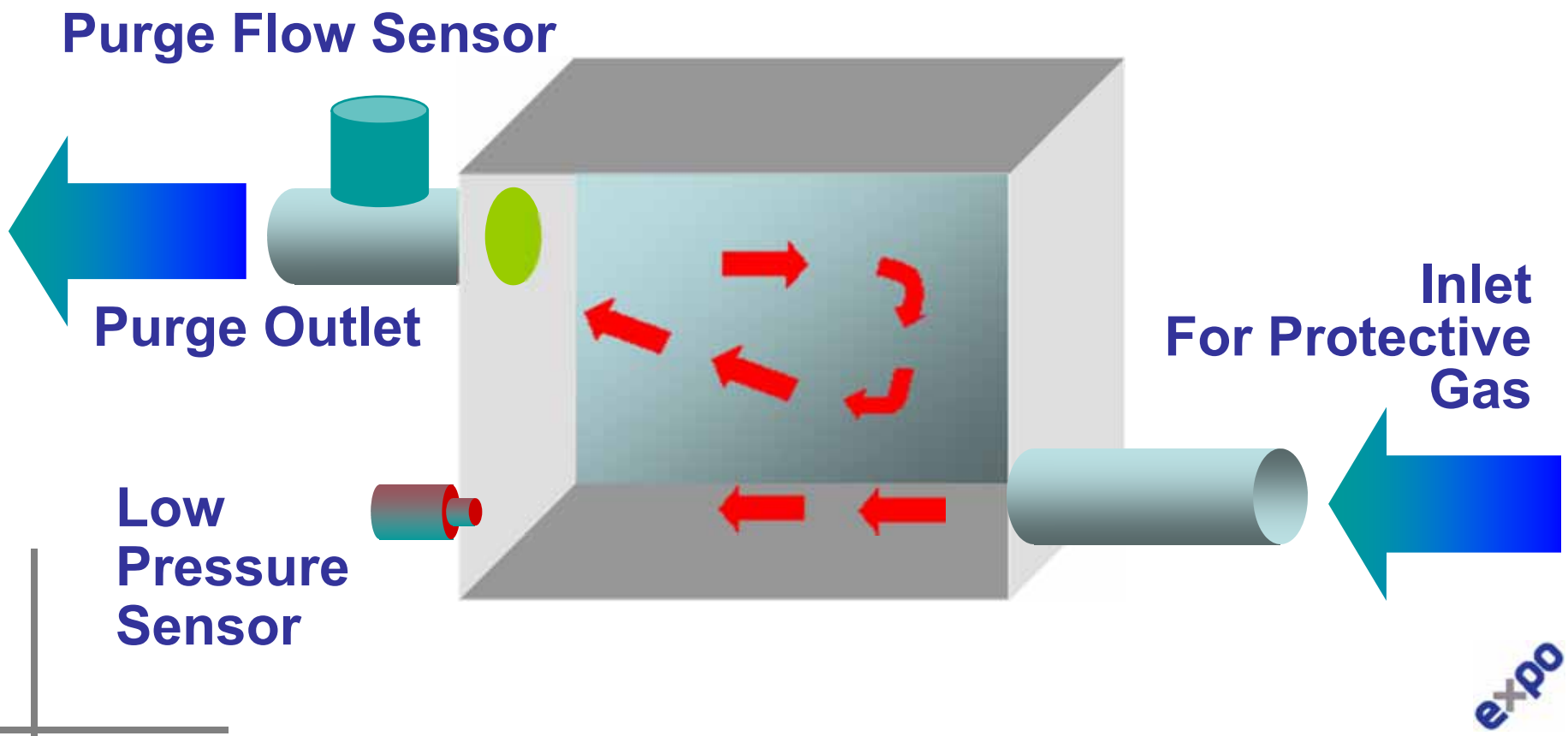
Or : 1 PSI = 27.681” of WC

Principles of Purge + Pressurization

NFPA 496 (NEC 500): 4 volume changes

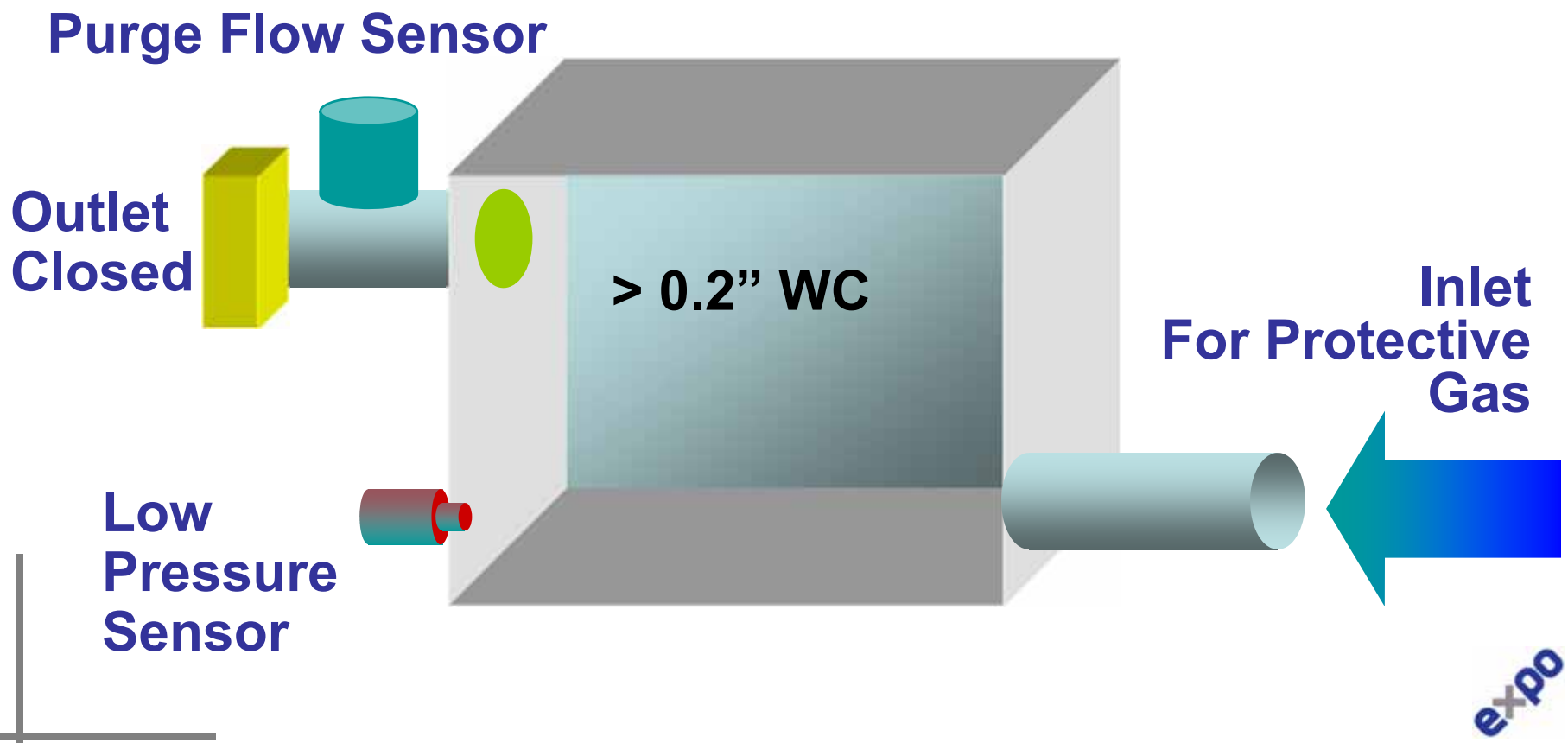
10 volume changes for Motors

IEC60079-2: 5 volume changes or purge test



Principles of Purge + Pressurization

After Purge, air is only required to compensate for leakage in the cabinet and maintain minimum pressure



Types of Purge + Pressurization

Purging

The types of pressurization are as follows:

TYPE ‘X’

TYPE ‘Y’

TYPE ‘Z’

Type Z Purge (Div 2, Grps A-D / Zone 2, Ex ‘pz’)

Reduces the classification within the protected enclosure from

Class I, Div 2* or *Zone 2* to *Unclassified

Type X Purge (Div 1, Grps A-D / Zone 1, Ex 'px')

Reduces the classification within the protected enclosure from

Class I, Div 1* or *Zone 1* to *Unclassified

Type Y Purge (Div 1, Grps A-D / Zone 1, Ex 'py')

Reduces the classification within the protected enclosure from

***Class I, Div 1* or *Zone 1* to**

Class I, Div 2* or *Zone 2

+ ***Note:*** **All electrical components inside enclosure must meet a Div 2 or Zone 2 rating, at a minimum.**

Purge + Pressurization Products/Systems

Mini-Z-Purge (Div 2, Grps A-D / Zone 2, Ex ‘pz’)

Reduces the classification within the protected enclosure from

Class I, Div 2* or *Zone 2* to *Unclassified

- (*Manual* PURGE Time & Application of Power)

Mini-Z-Purge (Div 2, Grps A-D / Zone 2, Ex ‘pz’)

+ Continuous Flow style

+ Direct Top or Side Mount

Local Visual Alarm

Flow Control Valve

SAU25

RLV25

Model 1ZCF/bp/IS includes RLV & SAU

Mini-Z-Purge (Div 2, Grps A-D / Zone 2, Ex ‘pz’)

+ Continuous Flow style

+ Panel Mount

Local Visual Alarm

Flow Control Valve

SAU25

RLV25

Model 1ZCF/pm/IS includes RLV & SAU

Mini-Z-Purge (Div 2, Grps A-D / Zone 2, Ex ‘pz’)

+ Leakage Compensation Style

+ Direct Top or Side Mount

Purge in Progress Indicator

Purge Control Valve

Local Visual ALARM

RLV25

Leakage Compensation Valve

Model 1ZLC/bp/IS includes RLV

Mini-Z-Purge (Div 2, Grps A-D / Zone 2, Ex ‘pz’)

+ Leakage Compensation Style

+ Panel Mount

Purge Control Valve

Purge in Progress

RLV25

Local Visual ALARM

Leakage Compensation Valve

Model 1ZLC/pm/IS includes RLV

Mini-Y-Purge (Div 1, Grps A-D / Zone 1, Ex 'py')

Reduces the classification within the protected enclosure from

***Class I, Div 1* or *Zone 1* to**

Class I, Div 2* or *Zone 2

- (*Manual* PURGE Time & Application of Power)

Type Y Purge (Div 1, Grps A-D / Zone 1, Ex ‘py’)

Continuous Flow

Leakage Compensation

+ The Mini-Y-Purge units are identical to the Mini-Z-Purge units, but with Division 1 “Y” Label in place of the Division 2 “Z” label

Mini-X-Purge (Div 1, Grps A-D / Zone 1, Ex ‘px’)

Reduces the classification within the protected enclosure from

Class I, Div 1* or *Zone 1* to *Unclassified

- (*Automatic* PURGE Time & Application of Power)

Mini-X-Purge (Div 1, Grps A-D / Zone 1, Ex ‘px’)

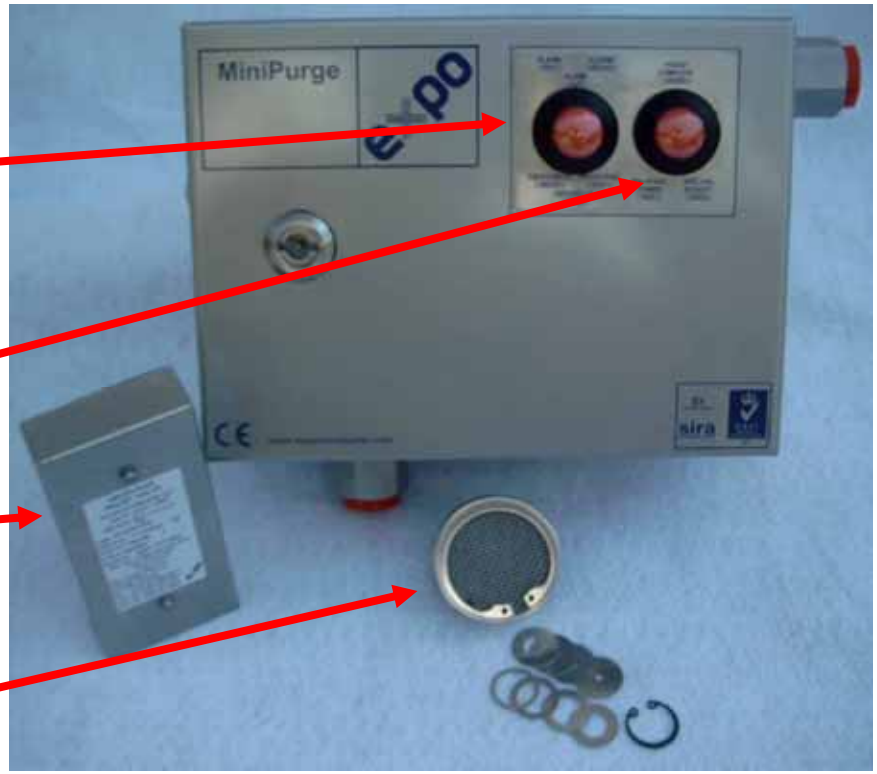
+ Continuous Flow style
+ Direct Top Mount

Local Visual ALARM

Purge Complete Indicator

RLV25

SAU25



Model 1XCF/ss/IS includes RLV & SAU

Mini-X-Purge (Div 1, Grps A-D / Zone 1, Ex ‘px’)

+ Leakage Compensation style
+ Direct Top Mount

Local Visual ALARM

RLV25

Purge In Progress Indicator

Model 1XLC/ss/IS includes RLV

Mini-X-Purge Mounting Options

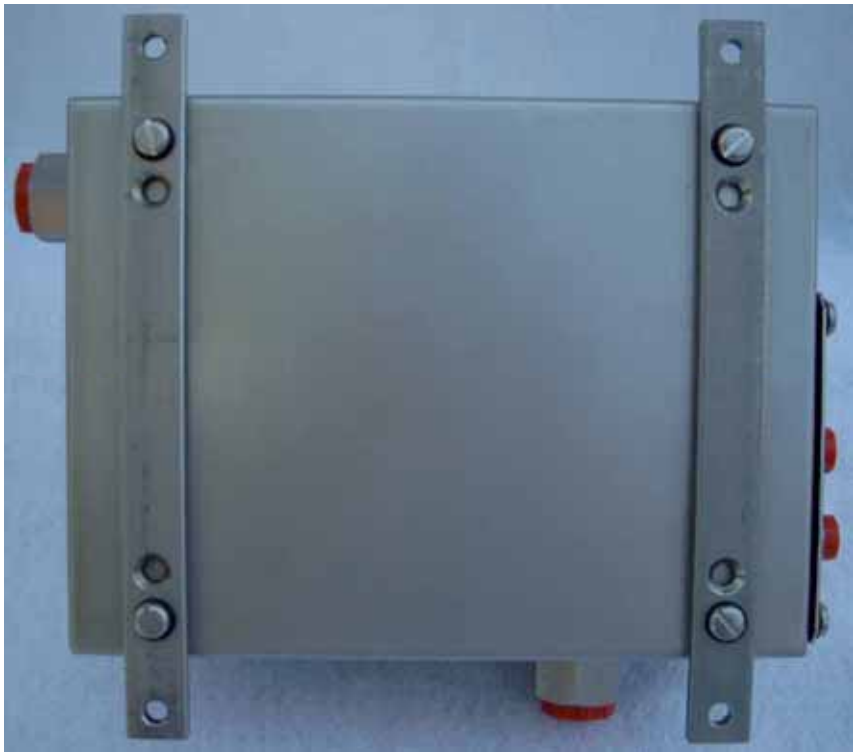
+ Panel Mount Option

Mini-X-Purge Mounting Options

+ **Side or Rear Mount**

Rear fixing screws standard

Mini-X-Purge Mounting Options



+ **Wall Mount**

Optional Mounting Bars

MiniPurge Interface Unit (MIU)

Three Standard Sizes, for use with Type ‘X’

4 Pole 35 Amp
+ 4 Pole 5 Amp

4 Pole 16 Amp +
4 Pole 5 Amp

4 Pole 16 Amp
600 Vac

Mini-X-Purge + MIU Mounting

+ Top Mount Kit

Applications

Applications

- Local Control Panels
- Motor Control Centers
- Motors
- Analyzer Sheds
- Hazardous Gas Analyzers
- Computer Work Stations
- Rooms
- Instrumentation Panels

Application Description

A small company based in the Pacific Northwest, building centrifuges for bio-diesel separation.

- Market for their product is very competitive.
- They need to keep their costs down.
- Location is in a Class I Div 2 area.
- Design size is a major factor.

Solution …..

+ 1ZCF/bp/IS
+ Two- (2) enclosures ‘Purging in Series’
+ ≤ 3 ft^3 total

Application Description

Manufacturer of cryogenic compressor systems.

- Mount controls in an enclosure with two- (2) individual compartments.
- End user discouraged objects extending from enclosure.
- The location is Class I Div 2.

Solution …..

- 1ZLC/bp/IS
  Panel mount unit:
  Low profile & flush mount
- Purging 2 in 1:
  Holes exist between compartments

Application Description

OEM of mass spectroscopy systems, designing unit to be located in a process area that is hazardous.

- Class I, Div 1 requirement
- System requiring a local display and keyboard.
- Keyboard and display needs to be accessible.

Solution …..

- Designed to Div 1, as well as ATEX, Zone 1
- Complete Expo system:

  1XLC/ss/PO + MIU, Enclosure and Datex Keyboard

Application Description

OEM in the plastics industry, designing their general purpose panel for hazardous areas.

- Decided to specify a purge system for protection.
- Area requirement calls for Class I, Div 1.
- Needed a ‘compact’ fit on top of their enclosure.
- Had to mount easily in “one piece.”

Solution …..

+ 1XLC/ss/PO + MIU with Top Mounting Kit
+ Factory assembled
+ Direct top mount & convenient one piece installation

Application Description

Finding a suitable barcode printer for a hazardous location.

- Area requirement is Class I Div 1
- Portability is required
- Printout must be accessible

Solution …..

- Complete System: 1XCF/ss/IS, pedestal and enclosure
- Printer media exit port designed to limit purge loss
- Port meets IP40


Dräger


08/16/2006


08/16/2006


LASENTEC


MiniPurge
expo


EXPO


EXPO
MINIPURGE


ADALET
ADALET
ORB
EMERGENCY
STOP
ORB
P-700
REID VAPOR PRESSURE
ANALYZER


Brandt
A Varco Company

Motor Purge System

Motor Purge System

Purge + Pressurizing Applications

(Just About) Anything In a Hazardous Location!

Questions, Comments, Etc.

THANK YOU for Attending!

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1-888-NFPA-496 (637-2496)

SmartPurge II

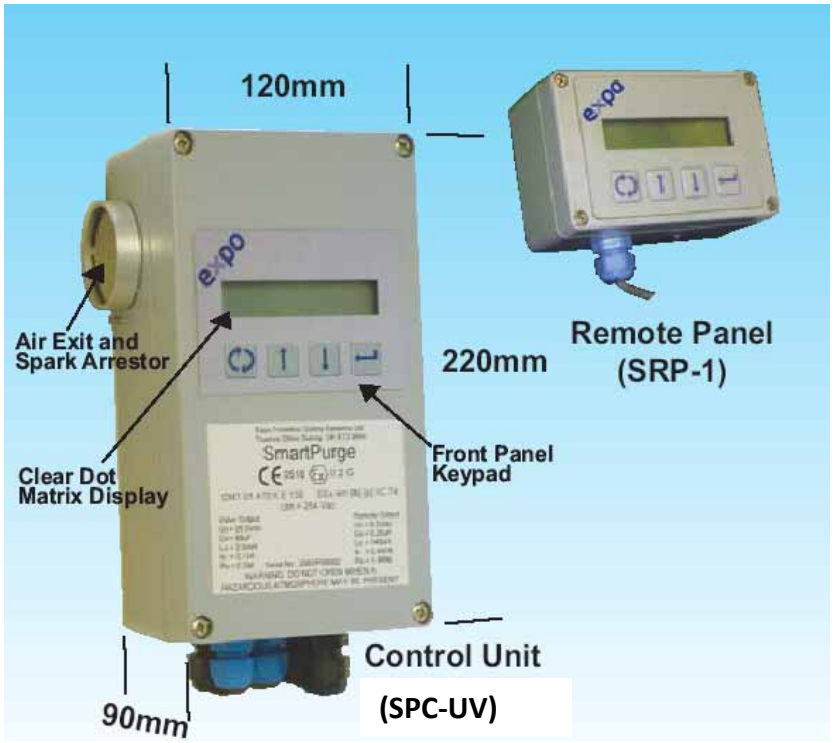
IECEx and **ATEX** certified intelligent purge and pressurisation system

Zone 1 Gas and Zone 21 Dust

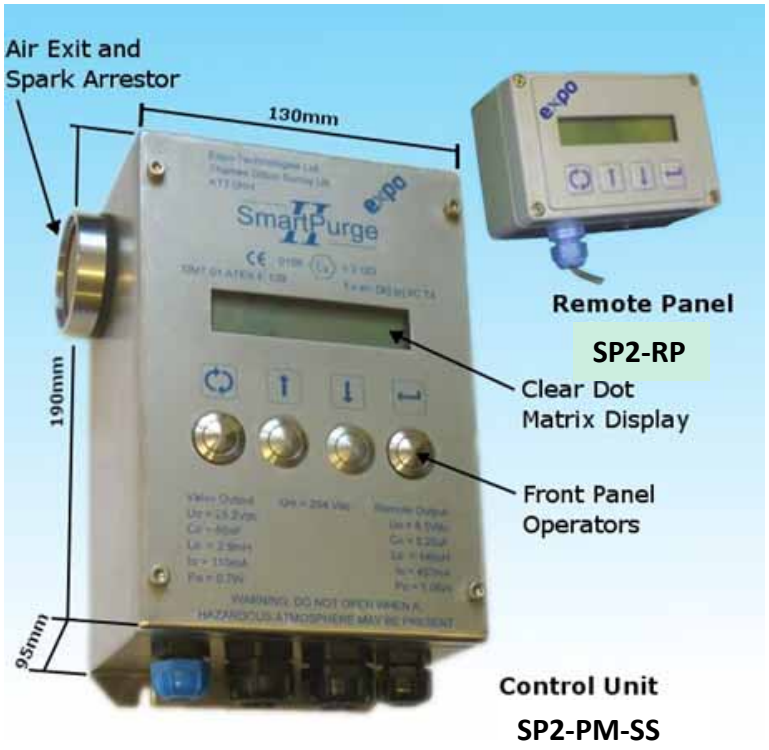
Suitable for Enclosure sizes up to 5.3 m³ (187 cu ft)

SmartPurge II
What has changed?

Old System SPC-UV



New System SP2-PM-SS



- Same mounting template
- Stainless Steel 316 replaces Aluminium
- AV buttons replace keypad

- Stainless Steel 316 Spark Arrestor
- Same accessories
- -20°C to + 60°C
- IECEx & ATEX certified

Overview of Competitors

Gönnheimer F850S (px)

Features:

- ATEX only (II 2 G D)
- Ex e mb IIC T6
- -10°C to +50°C at T6
- -10°C to +60°C at T4
- up to 430 LPM @ 25mbar
- Switches 5A load, 2 Alarms
- IP65 Aluminium with no external control
- Accessories: RP, DV, PV

Overview of Competitors

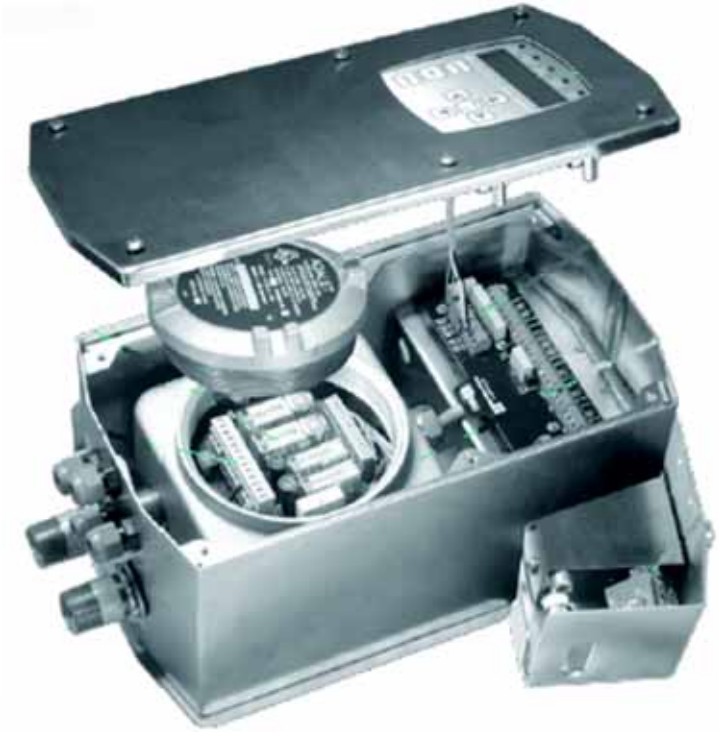
E.L.B (Extronics) F350 / iPurge200 (px)

Features:

- ATEX only (II 2 G D)
- Ex e mb ia IIC T4
- -30°C to +60°C at T4
- Up to 290 nl/pm @ 40mbar
- Single Alarm (Load Switch 12A)
- IP66 GRP with no external control
- Only simple two button control
- Accessories: Remote Display, HiFlo Kit, M/O
- Compact: 120H x 120W x 90D

Overview of Competitors

Pepperl & Fuchs Series 6000 (px)



Features:

- IEC & ATEX II 2 G D
- Ex e, ib, d IIC, T4
- -20°C to +60°C at T4
- up to 850 LPM @ 8mbar
- Switches 8A load (2 pole), 2 Alarms
- IP66 stainless 316 with external control
- Accessories: Remote Panel, Prop V, DV
- Bulky: 330H x 180W x 160D (12kg)

EXPO SmartPurge II

SP2 Range (px)

Features:

- IEC & ATEX II 2 G D
- Ex e, ib, mb IIC, T4 or T5
- -20°C to +60°C (-4°F to 140°F)
- up to 540 n/lpm @ 12mbar
- Switches 6A load (2 pole), 2 Alarms
- IP65 stainless 316 with external control
- Accessories: SDV, SRP, etc
- Compact :190H x 130W x 95D
- Weight 4.21 Kg (9.3Ibs)

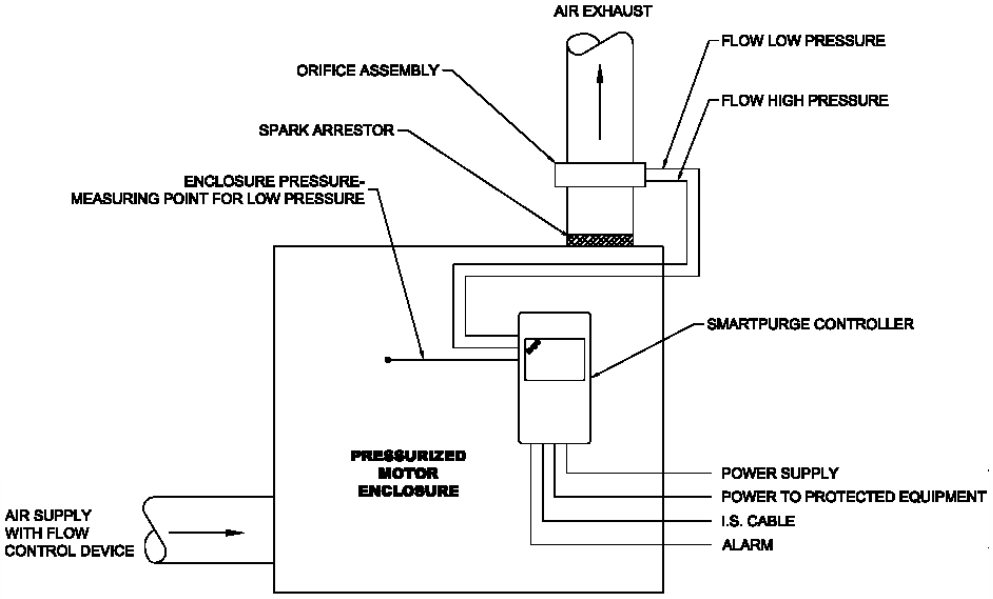
Overview of Expo Range

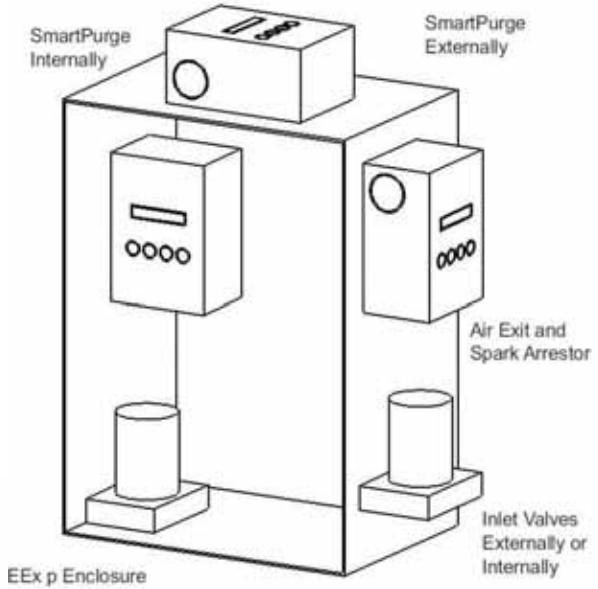
SP2-PM (85-254Vac)
SP2-PL (11-28Vdc)

Up to 540 LPM

SP2-FM (85-254Vac)
SP2-FL (11-28Vdc)

ΔP up to 50mbar



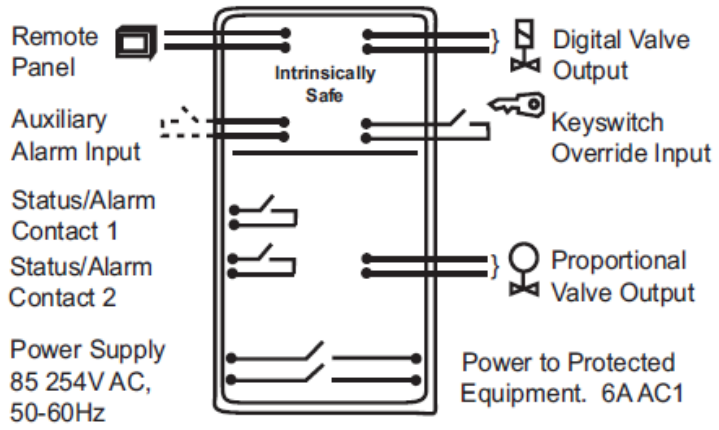


EXPO SmartPurge II

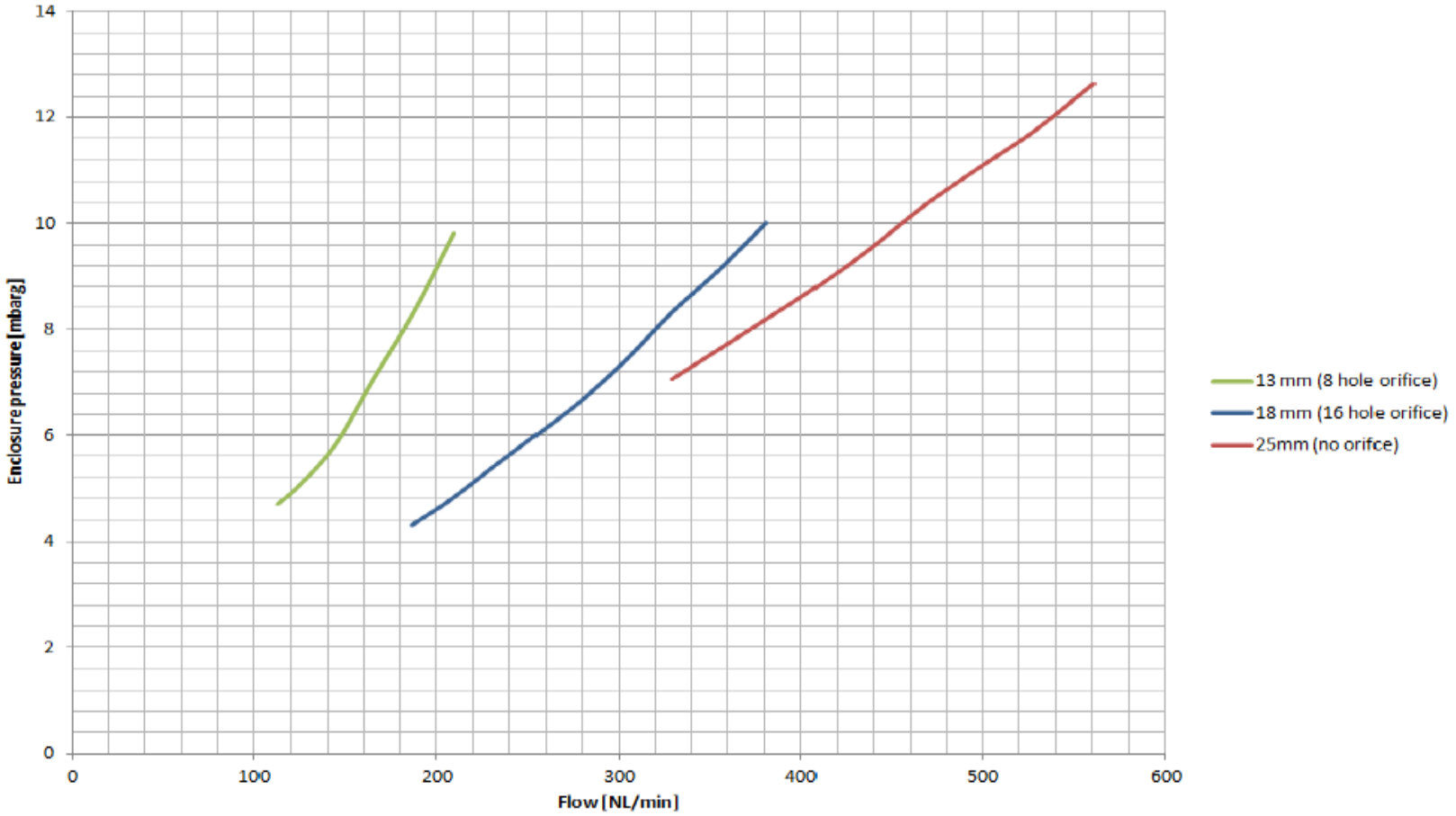
Features of

SP2-PM-SS

SP2-LV-SS



- Range of Accessories
- Up to 540 l/pm with an Expo enclosure
- 600 l/pm firmware limit
- Elapsed time or Adaptive flow
- Purge time up to 99 min
- Delay Trip up to 99 min
- 2 Configurable Alarms
- Alarm In: Purge Inhibit, Door Interlock
- 4-20mA I/P converter output

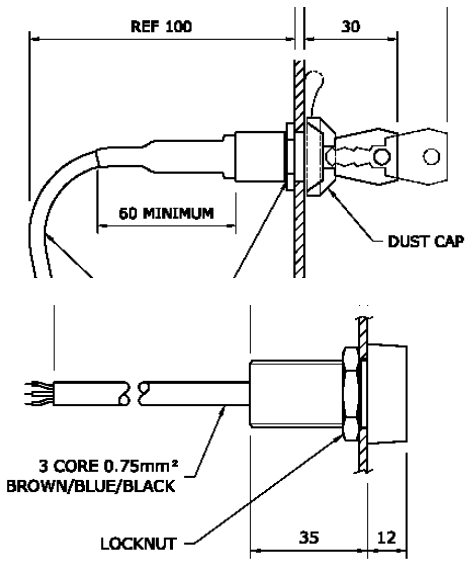


Inlet Flow Restrictor
(For SDV only)

Outlet Orifice

Accessories

- SP2-DV IS Digital Valve
- SP2-RP Aluminium Remote Panel (up to 50m)
- SP2-US M/O Keyswitch
- SP2-RL Remote Status Indicator
- SP2-SIU >6A Loads, Signals etc.
- SP2-CF up to 225 n/lpm
- SP2-CV IP66 Cover for PE2e



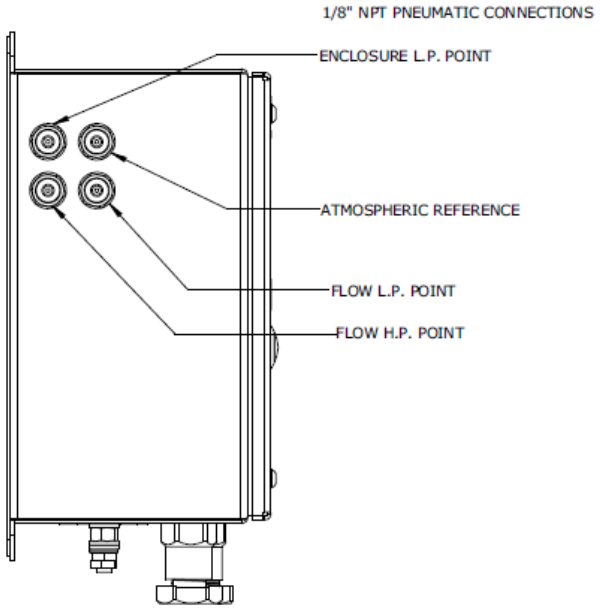
SP2- DV

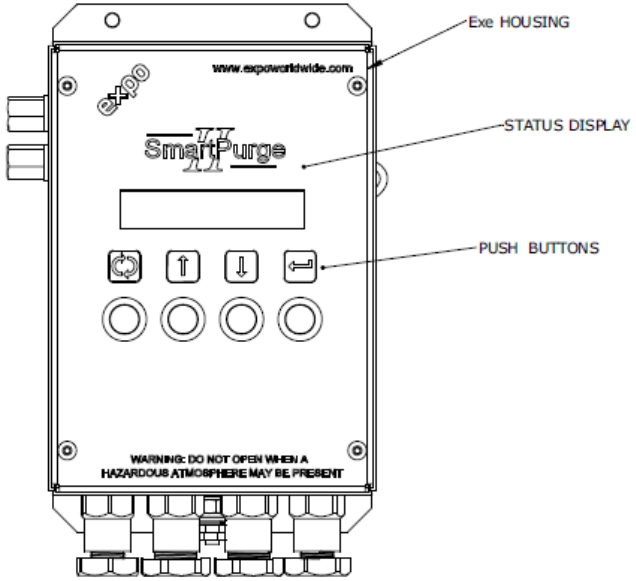
SP2- CF

SP2- RP

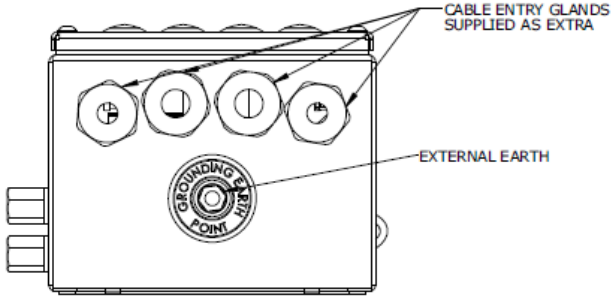
SP2- SIU

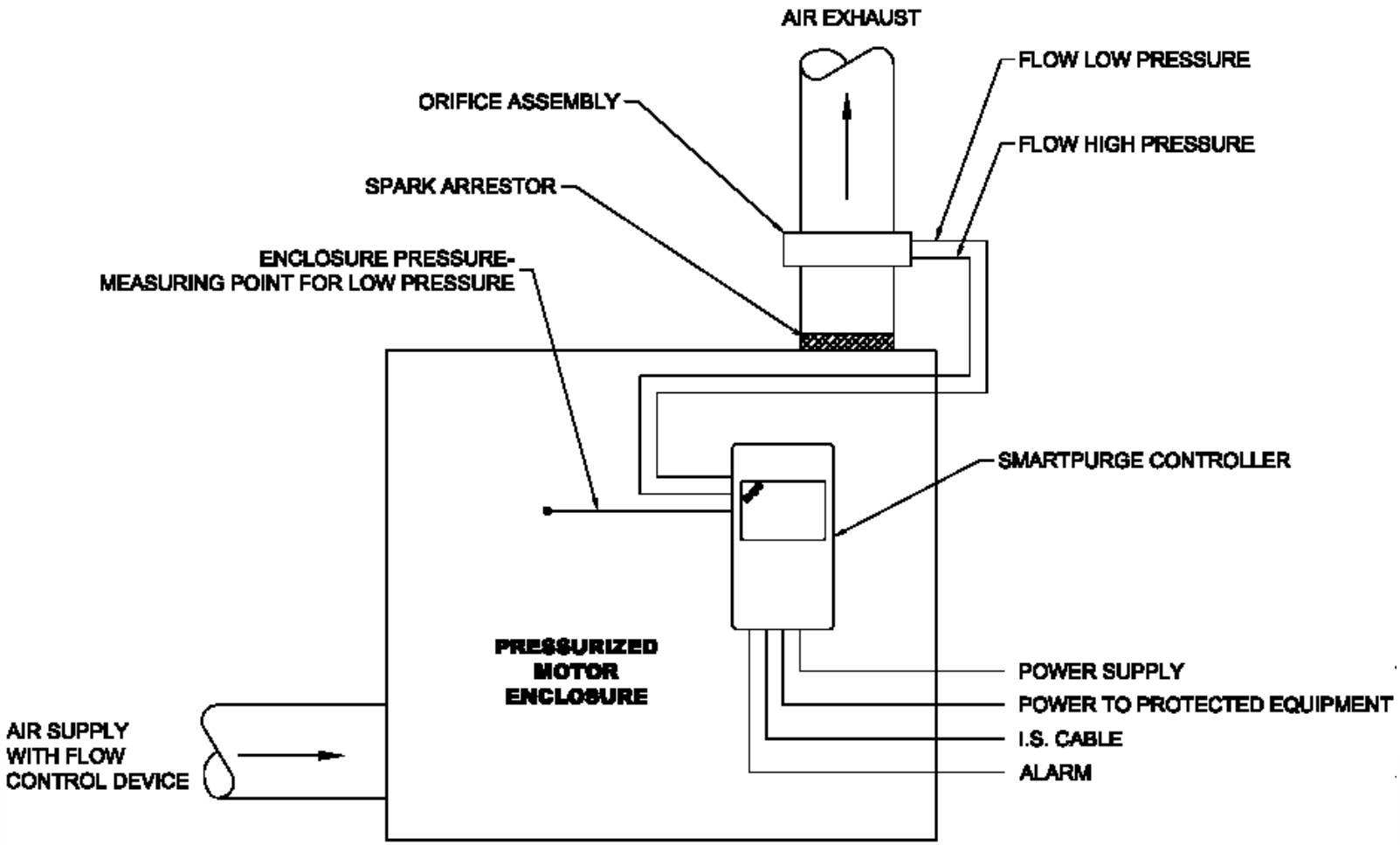
SmartPurge II Fan System





NOTES
1. WEIGHT IS APPROXIMATELY 4.2 KG
2. ON INSTALLATION ENSURE THAT FIXING BOLTS ARE EVENLY TIGHTED




AIR EXHAUST
FLOW LOW PRESSURE
ORIFICE ASSEMBLY
FLOW HIGH PRESSURE
SPARK ARRESTOR
ENCLOSURE PRESSURE-
MEASURING POINT FOR LOW PRESSURE
SMARTPURGE CONTROLLER
PRESSURIZED
MOTOR
ENCLOSURE
POWER SUPPLY
POWER TO PROTECTED EQUIPMENT
I.S. CABLE
ALARM
AIR SUPPLY
WITH FLOW
CONTROL DEVICE