

ARMAN^{fire} *Chef*

Kitchen Fire Suppression

Design and Calculations Manual



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LPCB Cert ref. 1408a

**Automatic fixed fire extinguishing systems for industrial
kitchens and deep fat fryers**



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Version	Amendment date	Amendment	Staff
1.1	10/01/16	Amendment	S. Andreu
1.2	10/10/16	Amendment	S. Andreu
1.3	24/10/16	Amendment	S. Andreu
1.4	03/11/16	Amendment	S. Andreu
1.5	18/04/17	Amendment	S. Andreu
1.6	18/05/17	Amendment	S. Andreu

1. GENERAL SYSTEM DATA

System pressure (at 20°C)	20 bar
Operating pressure range	17 – 22,2 bar
Operating temperature range	0 °C to 50 °C
Pressurization gas	Nitrogen (N ₂)
Fryer size	Max. Capacity: 45 litres Max. Area: 0,5 x 0,6 m (0,3 m ²)
Quantity of fryers or equipment to protect	Max. 7 fryers or kitchen equipment
Quantity of Nozzles	Max. 10
Flow rate	2 litres / Nozzle
Extinguishing time	35 – 45 seconds
Spray length of plenum protection nozzle	Max 4 m for kitchen hood length
Distance between nozzles for full protection*	Max 800 mm
Cross section of extinguishing pipe	Ø 10 x 1 mm (Inner diameter of fittings Ø8 mm)

*Overlapping of the spray cones

System limits regarding the protected project:

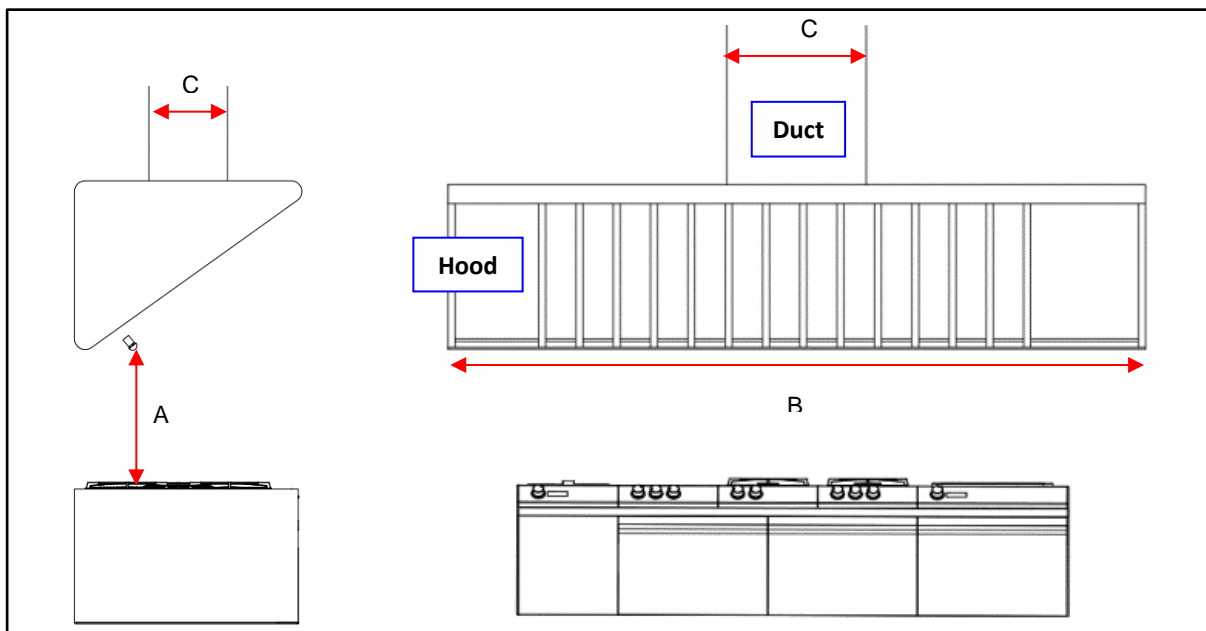


Fig. 1 –Duct and kitchen hood dimensions

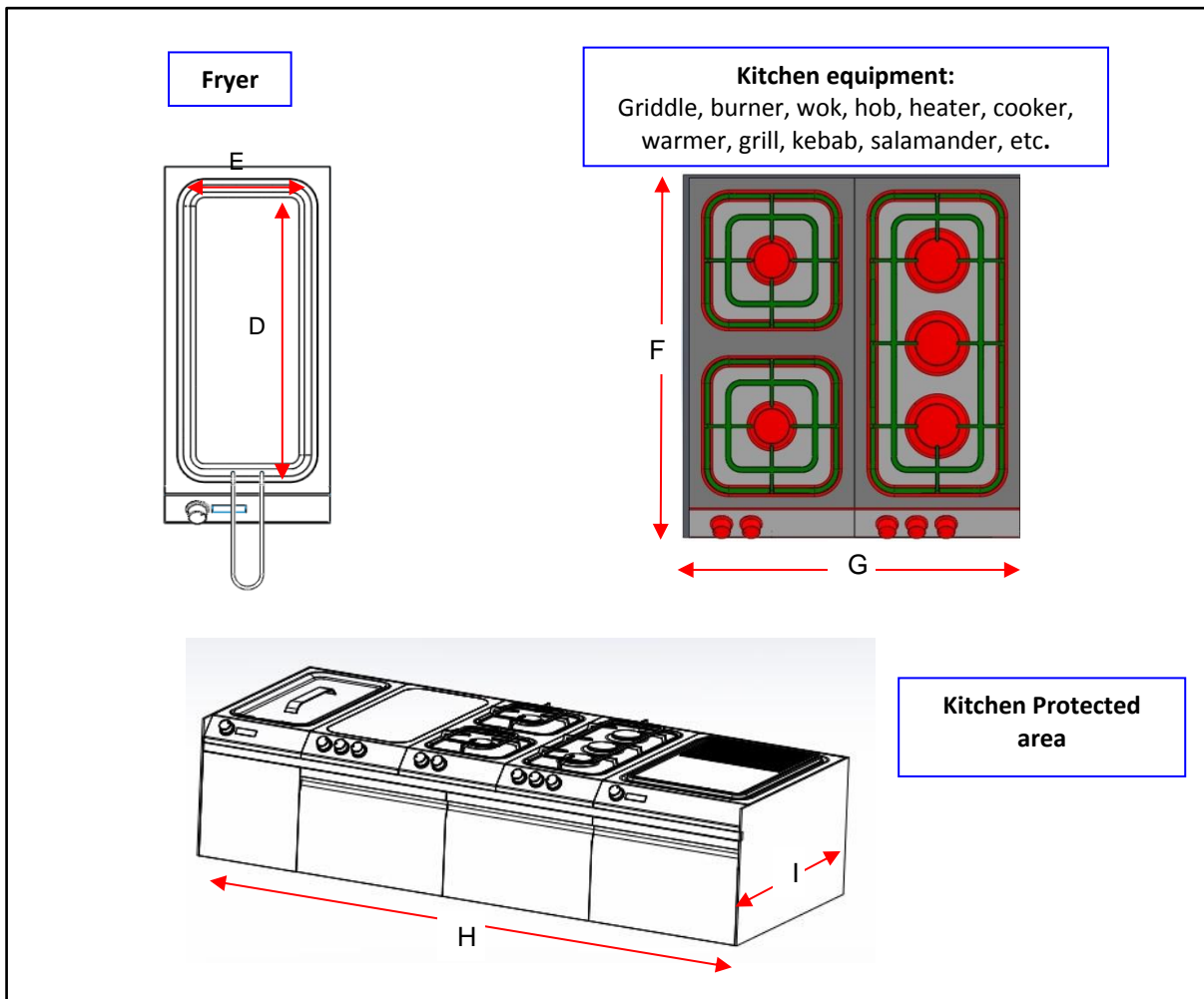


Fig. 2 – Fryers and Kitchen equipment dimensions

Dimension	Description	Range / Limits	
A	Distance between the extinguishing nozzles and the surface to be protected	900 – 1350 mm	
B	Length extractor hood (Full protection)	Max. 5600 mm	
	Length extractor hood (Zone protection)	Max. 8000 mm	
C	Cross-section extractor duct	Max. 500 x 500 mm	
D	Max Length deep fat fryer basin	500 mm	For max. total surface area 0.3 m²
E	Max Width deep fat fryer basin	600 mm	
F	Max Length of each kitchen equipment	800 mm	For max. total surface area 1.6 m²
G	Max Width of each kitchen equipment	800 mm	
H x I	Protected kitchen area	Max 4.48 m² (5,6 x 0,8)	

2. SYSTEM DESIGN AND CALCULATIONS

2.1. Choose the type of protection

2.1.1. FULL protection (Protection of the complete kitchen surface)

To reach a full protection of the kitchen surface, a distance between the fryer nozzles of maximum 800 mm must be kept. When this distance enlarges, there will be no overlapping of the spray cones.

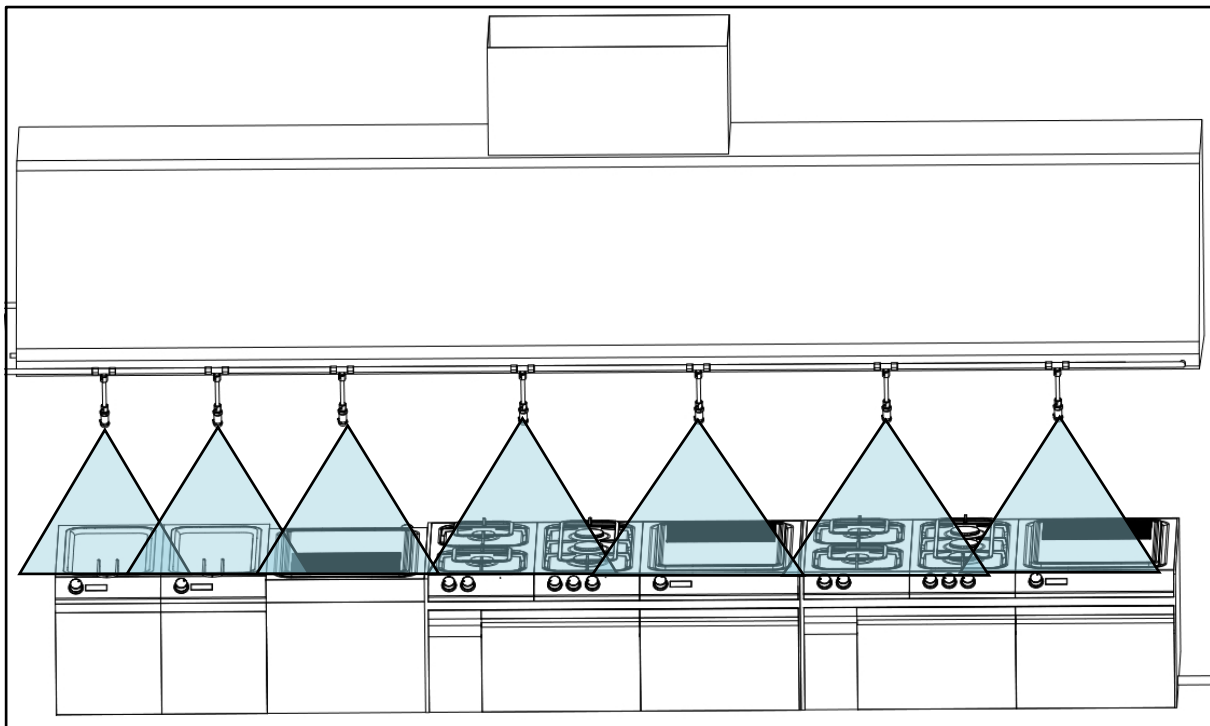


Fig. 3 – Nozzle configuration for FULL PROTECTION

2.1.2. Zone protection (Protection of some parts of the kitchen)

Using this kind of protection, some parts/equipment of the kitchen won't be protected due to there isn't any risk of fire in these zones.

Only specific areas and equipment must be protected, the distance between the nozzles can be increased. The fryer nozzles must be placed centered above the protected surface.

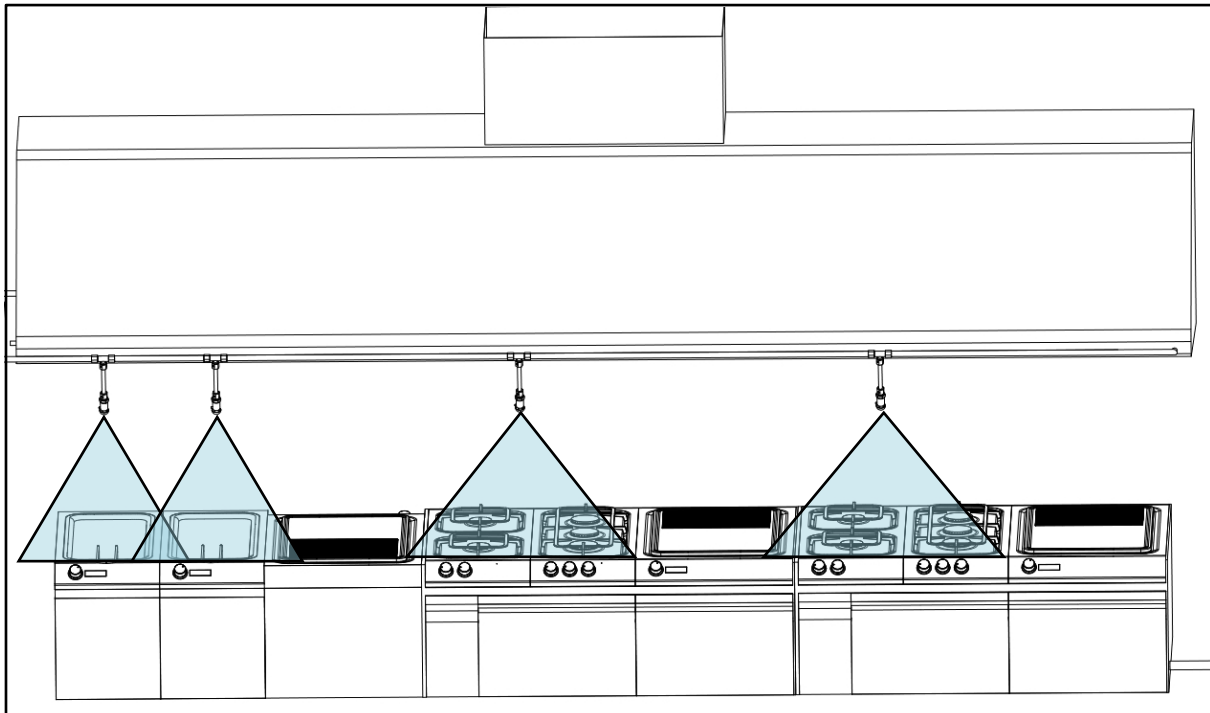


Fig. 4 – Nozzle configuration for ZONE PROTECTION

2.2. Nozzle Quantity Calculation

2.2.1. Nozzle calculations for FULL PROTECTION

N_q	Required N° Nozzles for the system design
W	Round up (Length of protected area / 0,8)
X	Round up (Width of protected area / 0,8)
Y	Round up (Length of protected Hood / 4)
Z	Number of protected ducts
$N_q = W * X + Y + Z$	

2.2.2. Nozzle calculations for ZONE PROTECTION

N_q	Required N° Nozzles for the system design
W	Quantity of protected KITCHEN EQUIPMENT
X	Quantity of protected FRYERS
Y	Round up (Length of protected Hood / 4)
Z	Number of protected ducts
$N_q = W + X + Y + Z$	

2.3. Extinguishing agent quantity calculation

2 * Quantity of Nozzles	=	Agent Quantity Needed in Litre
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2.4. Cylinder size Selection

Agent Quantity Needed	Required cylinder size / LPCB approved Cylinder code	Required cylinder size / Cylinder code
6 Litre	11,8 Litres	11,5 Litres
8 Litre	034313	034303
10 Litre	15,9 Litres	15,6 Litres
12 Litre	034314	034304
14 Litre	25,3 Litres	25,0 Litres
16 Litre		
18 Litre		
20 Litre		
	034315	034305

Part number	Cyl. Size/ Max. Ext. agent	Cylinder Diameter	Cylinder Height	Material
034303	11,5 litres/ 8 litres	190 mm	475 mm	Steel alloy red painted (RAL 3000) with internal plastic coat
034304	15,6 litres/ 12 litres	190 mm	620 mm	
034305	25 litres/ 20 litres	293 mm	460 mm	

LPCB approved cylinders:

Part number	Cyl. Size/ Max. Ext. agent	Cylinder Diameter	Cylinder Height	Material
034313	11,8 litres/ 8 litres	190 mm	475 mm	Stainless Steel Body: AISI 304 Neck: AISI 316
034314	15,9 litres/ 12 litres	190 mm	620 mm	
034315	25,3 litres/ 20 litres	293 mm	460 mm	

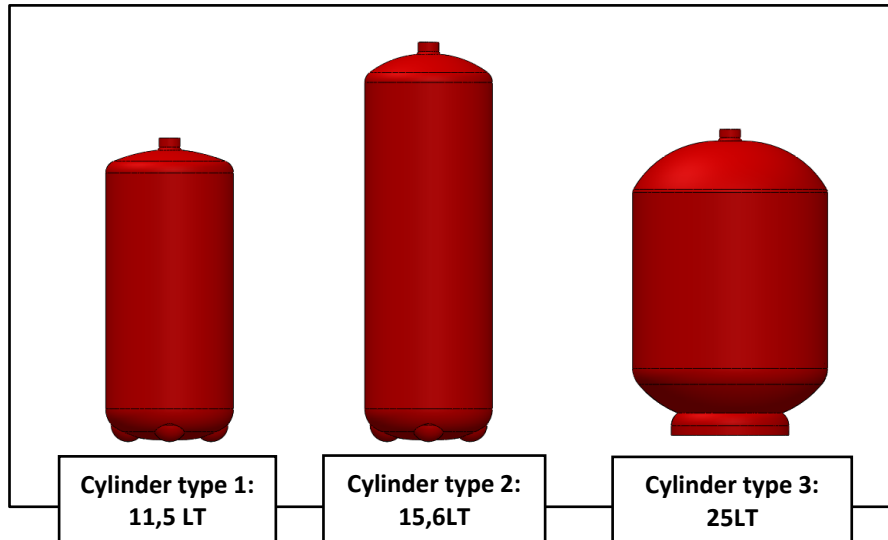


Fig. 5 – Cylinder types – Steel alloy Red painted with internal plastic coat

LPCB approved cylinders:

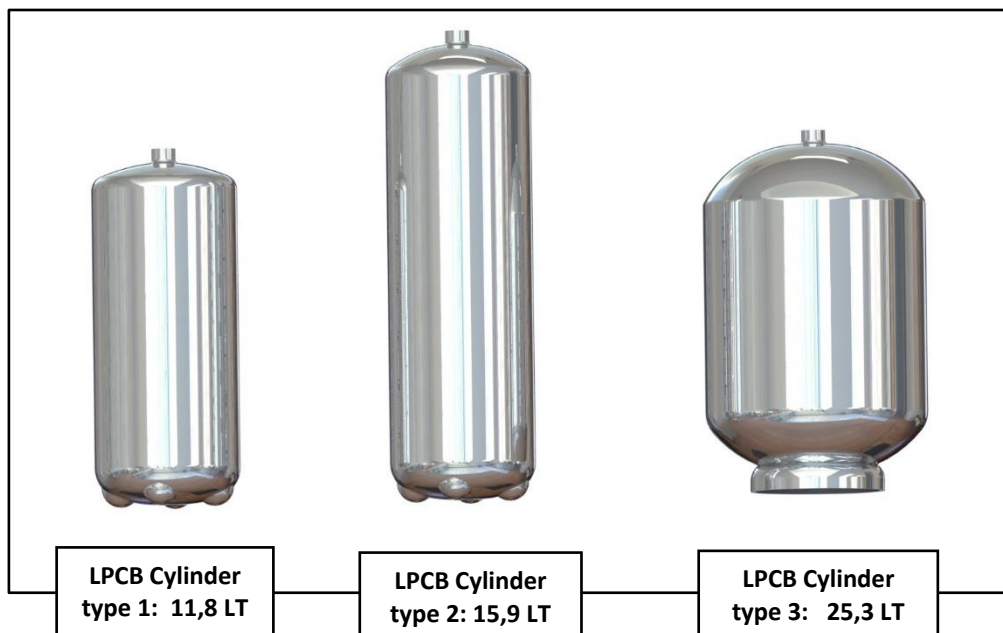


Fig. 6 – Cylinder types – Stainless steel

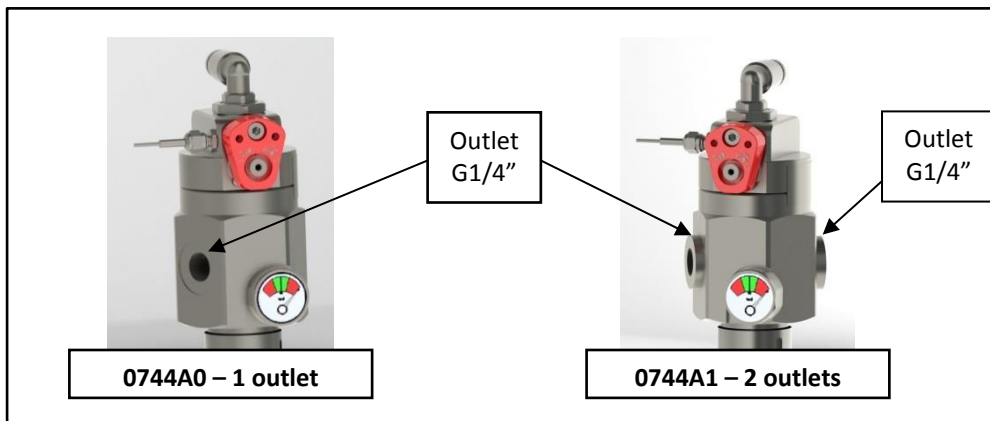


Fig. 7 – Valve types

2.5. Choosing system type

System code	No. of nozzles per system	System type	Number of vessels	Extinguisher lines	Cylinder valve code
ARFCHEF06B	3	System P	1 x Cylinder type 1	1 x \varnothing 10x1mm	0744A0 (1 outlet)
ARFCHEF08B	4				
ARFCHEF10B	5	System M	1 x Cylinder type 2	2 x \varnothing 10x1mm	0744A1 (2 outlets)
ARFCHEF12B	6		1 x Cylinder type 3		
ARFCHEF14B	7				
ARFCHEF16B	8	System G	1 x Cylinder type 3	1 x \varnothing 10x1mm (ring loop)	0744A1 (2 outlets)
ARFCHEF18B	9				
ARFCHEF20B	10				

LPCB approved cylinders:

System code	No. of nozzles per system	System type	Number of vessels	Extinguisher lines	Cylinder valve code
ARFCHEF06C	3	System P	1 x Cylinder type 1	1 x \varnothing 10x1mm	0744A0 (1 outlet)
ARFCHEF08C	4				
ARFCHEF10C	5	System M	1 x Cylinder type 2	2 x \varnothing 10x1mm	0744A1 (2 outlets)
ARFCHEF12C	6		1 x Cylinder type 3		
ARFCHEF14C	7				
ARFCHEF16C	8	System G	1 x Cylinder type 3	1 x \varnothing 10x1mm (ring loop)	0744A1 (2 outlets)
ARFCHEF18C	9				
ARFCHEF20C	10				

2.6. Limitations for Easydetect tube and piping system

		System P "Piccolo"		System M "Mezzo"			System G "Grande"		
		ARFCHEF06C ARFCHEF06B	ARFCHEF08C ARFCHEF08B	ARFCHEF10C ARFCHEF10B	ARFCHEF12C ARFCHEF12B	ARFCHEF14C ARFCHEF14B	ARFCHEF16C ARFCHEF16B	ARFCHEF18C ARFCHEF18B	ARFCHEF20C ARFCHEF20B
P	Cylinder capacity [Litres]	11,5		15,6			25		
	Total amount of extinguishing agent [Litres]	6	8	10	12	14	16	18	20
	Total amount of pressurizing gas (N ₂) per cylinder volume [Litre]	5,5	3,5	5,6	3,6	11	9	7	5
Q _s	Maximum Number of Nozzles Short reach	3	4	5	6	7	8	9	10
Q _L	Maximum Number of Nozzles Long reach	1	1	2	2	2	2	2	2
Q _T	Total Number of Nozzles	3	4	5	6	7	8	9	10
R	Maximum length of extractor hood with zone protection [mm]	4000		8000			8000		
U	Maximum Length of the kitchen surface to be protected for complete protection [mm]	800	1600	2400	3200	3200	4000	4800	5600
V	Maximum Width of the worktop surface to be protected [mm]	800	800	800	800	800	800	800	800
T	Max Length Easydetect Tube [m]	10		20			30		
S	Max. Quantity of fitting	6		6			8		
	Max. Line length of pipe [m]	7		2 x 7 (14)			20		
-	Max. Line valve - Last nozzle [m]	5		7			10		

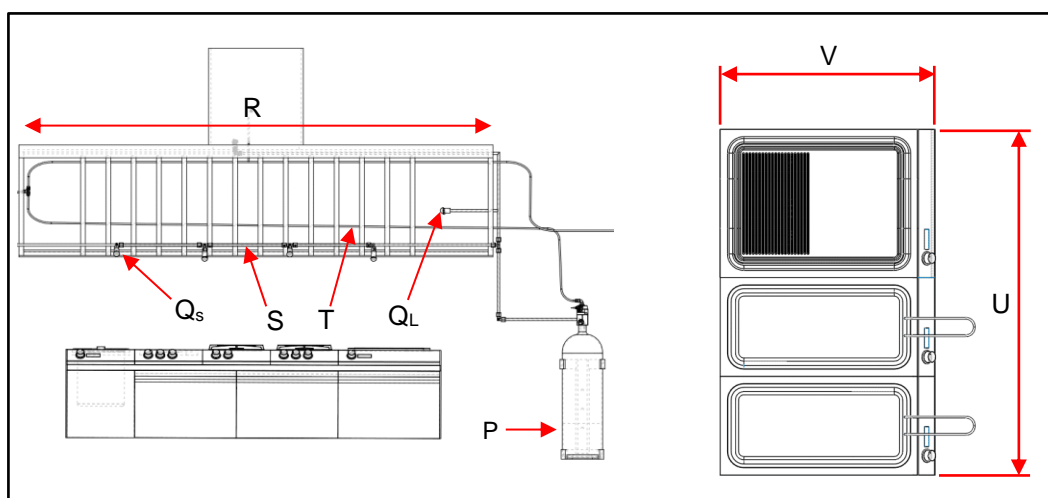


Fig. 8 – Installation features

2.7. Extinguishing agent

The extinguishing agent has a significant influence on the extinguishing result (especially in the case of grease fires) but also factors such as the corrosive behaviour and performance have been taken into account when selecting a suitable agent.

It combines the perfect extinguishing properties of a foam agent with an optimized biological tolerance. It is biodegradable to more than 99% and is therefore not classified as hazardous waste. In addition, after having been expelled, the residues can be used as a cleaning agent, because it has excellent cleaning and degreasing properties.



Not using the recommended extinguishing agent by AIRfire will cause problems with the extinction in case of a fire (not guaranteed).

AIRfire is not responsible for systems refilled with inadequate agent.

3. SYSTEM SETUP

3.1. Installation plans for extinguishing pipe and nozzles

3.1.1. System type 1 – ARMANfire Chef “Piccolo”: One extinguishing line

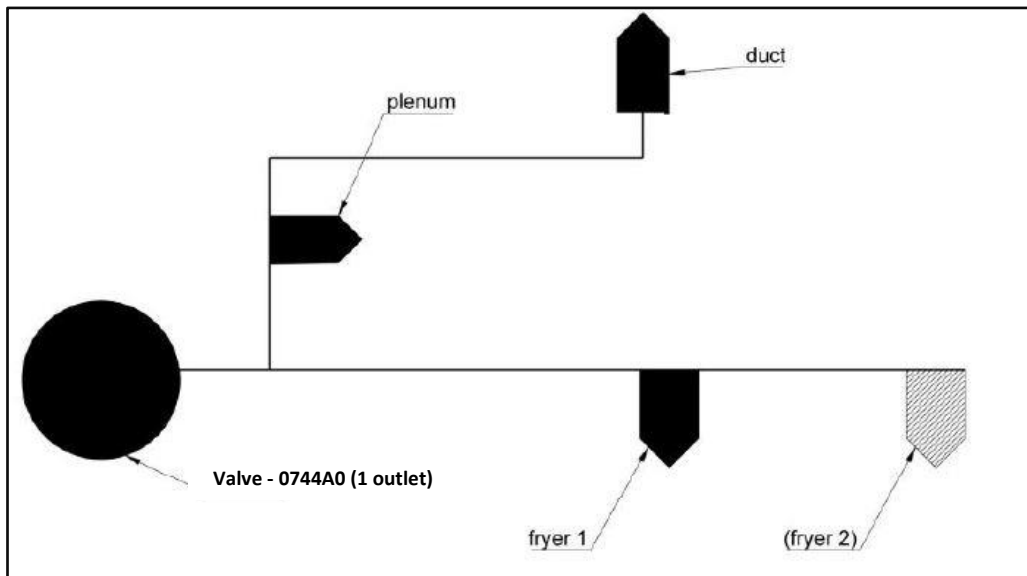


Fig. 9 – Typical and basic scheme for piping layout of System “Piccolo”

3.1.2. System type 2 – ARMANfire Chef “Medio”: Two Nozzle lines

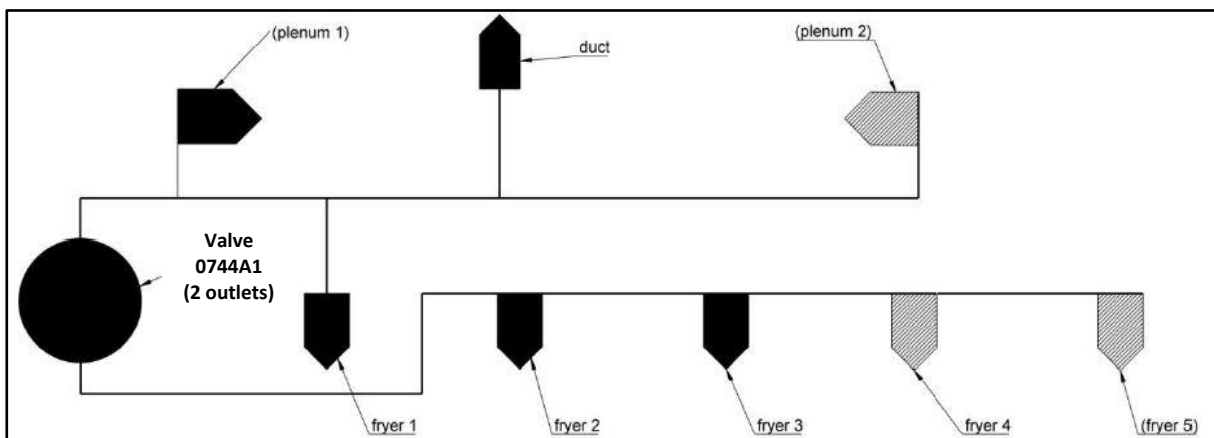


Fig. 10 – Typical and basic scheme for piping layout of System “Medio”

Observations: The nozzle quantity must be split symmetrically on both discharge lines and the length of both lines should be nearly the same.

3.1.3. System type 3 – ARMANfire Chef “Grande”: Loop connection Nozzle line

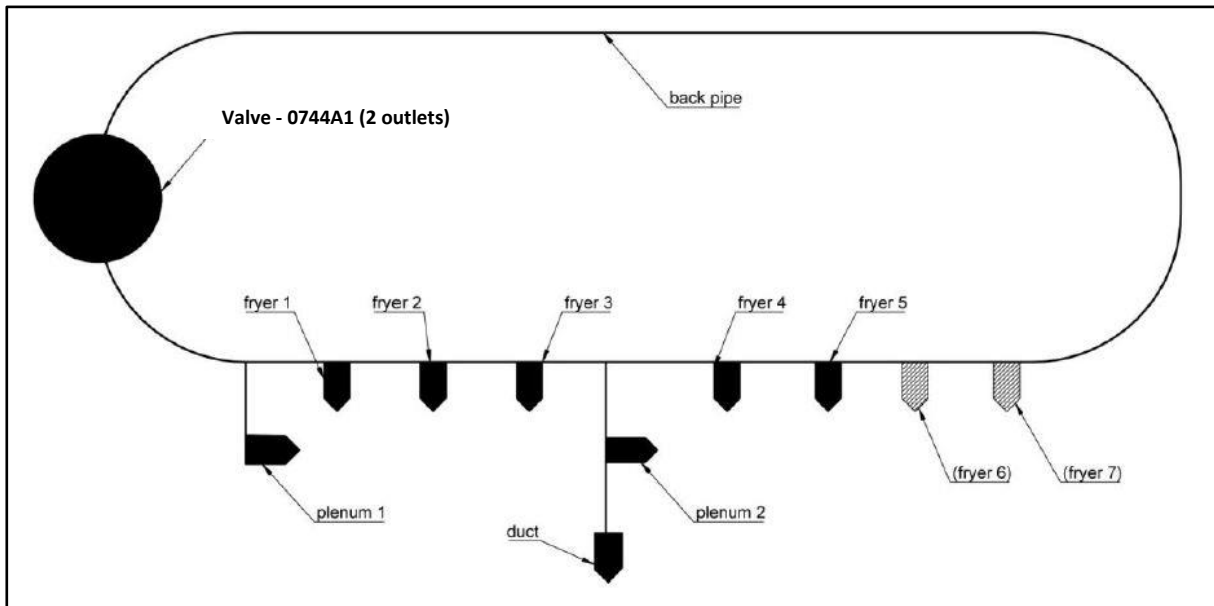


Fig. 11 – Typical and basic scheme for piping layout of System “Grande”

Observations: The Discharge line for this system variant must be a loop: In one outlet of the cylinder valve starts the discharge line and finish in the other outlet.

4. Important notes for the installation

4.1. Installation of pipework and plenum nozzles

Use pipe bends instead of elbow fittings (better flow performance, cheaper)

- The cross section of the pipe mustn't change during the bending process

Use as less fittings as possible

Nozzles and branches must be placed only in the main pipe, not in the back pipe

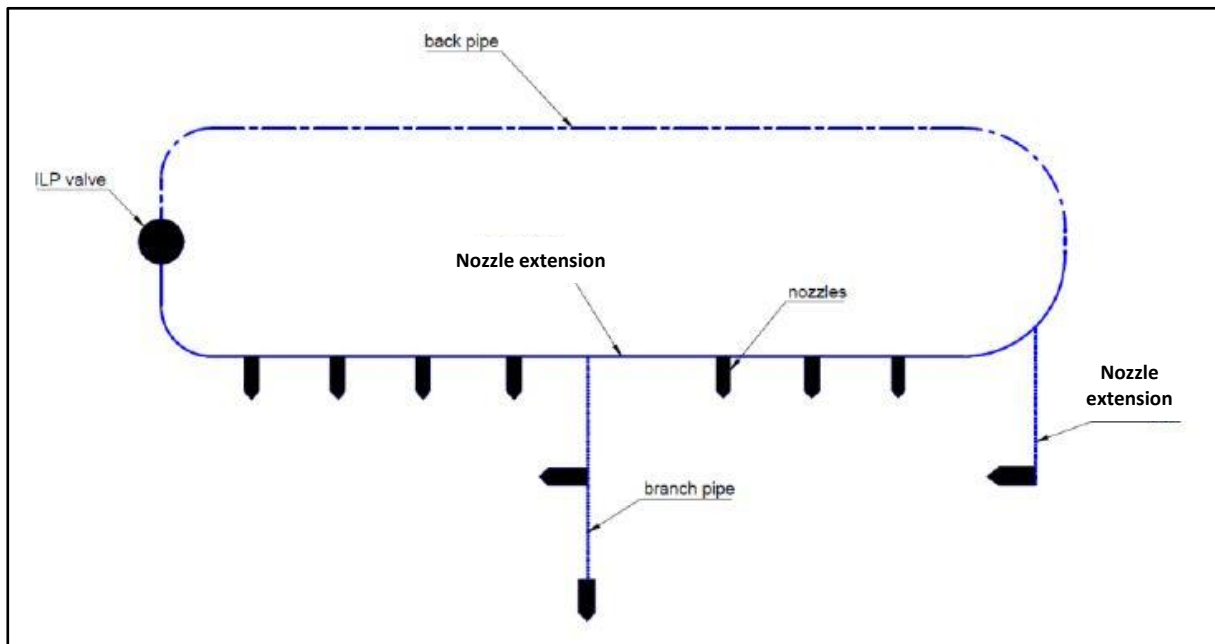


Fig. 12 – System type “Grande”: Main pipe and back pipe

4.2. Leakage monitoring (indication of system status)

Because of the higher system pressure of 20 bar at 20 °C, a special contact gauge for the leakage monitoring is needed

- This contact gauge has a switching point of 17 bar
- This switching point is crucial to ensure the system performance in case of fire (below 17 bar the system doesn't work properly)
- AIRfire offers this contact gauge Normally Open (NO) as standard version. A contact gauge Normally Close can be offered under request.

4.3. Easydetect tube Installation

- Use as less fittings as possible and keep the Easydetect tube short to reduce leakages and permeation
But don't save Easydetect tube length in critical areas (above the fryers...)

- Use only suitable tools and components. AIRfire recommends the use of the Starter Kit for the installation and maintenance of the ARMANfire systems.

4.4. Starter Kit



Fig. 13 – Starter Kit

1. **Special tube scissors** – To cut the Easydetect tube at the right angle
2. **Deburring tool** – To deburr the Easydetect tube for an easy quick coupling with fittings.
3. **Multi-tool** – For the system installation
4. **Easyfill** – Easydetect tube pressurization
5. **Filling connector G1/8"** – For cylinder refilling
6. **Filling connector M10** – For Easydetect tube connection to the Easyfill
7. **Filling adapter** – Adapter for Easyfill connection and refill
8. **Laser pointer** – As optional component for the adjustment and alignment of the Nozzles



The Easyfill is used to provide pressurized gas during installation and servicing, because the sensor tube must be filled before opening the cylinder valve from the end-of-line or through suitable connections. In addition, the pressurization of the extinguishing agent vessel and the leakage test of the extinguishing line can be checked with this tool. Filling the pressure gas cartridge is described in the respective operating instructions.

5. COMPONENTS

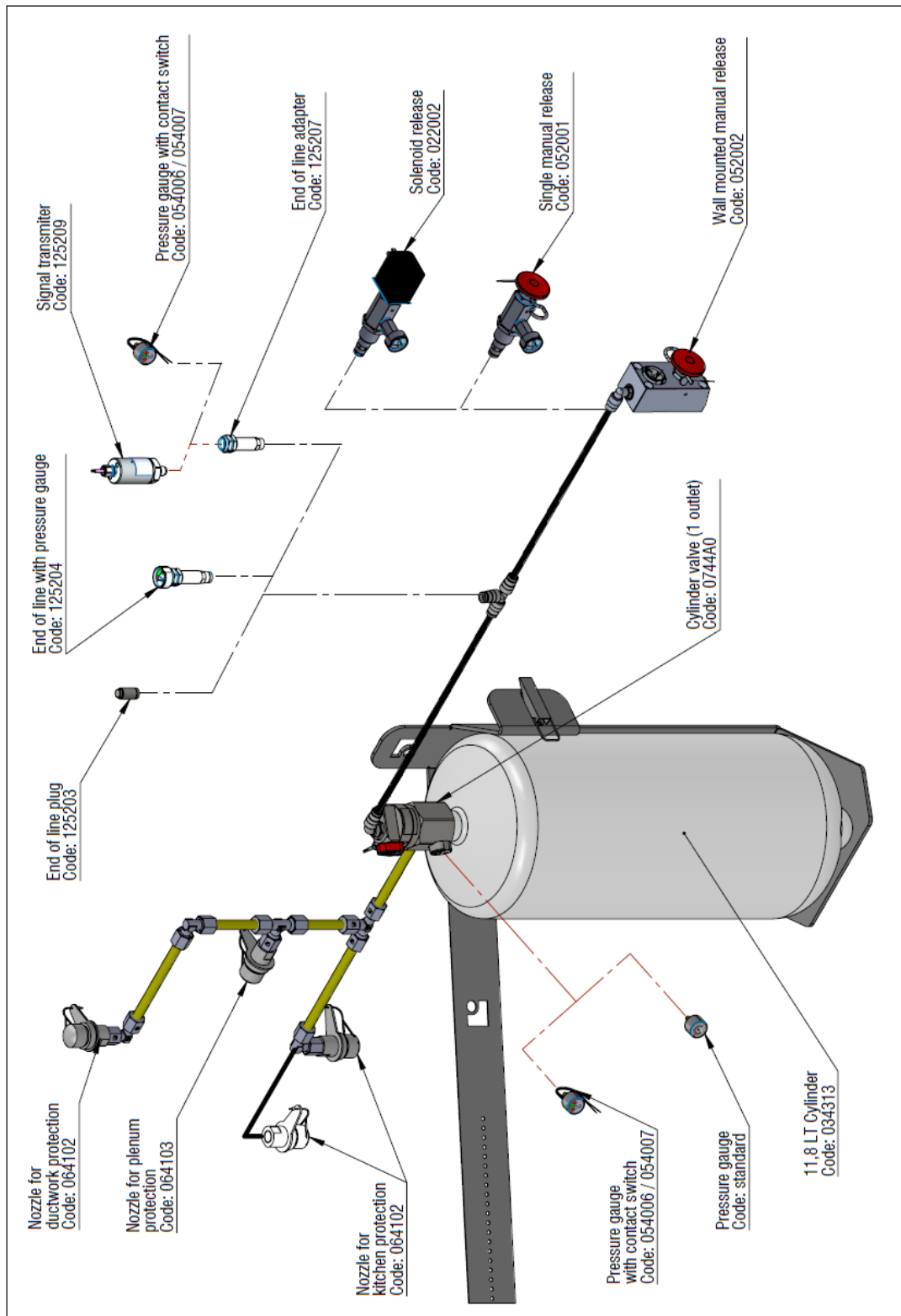


Fig. 14 – Components of System type “Piccolo” – LPCB approved cylinders

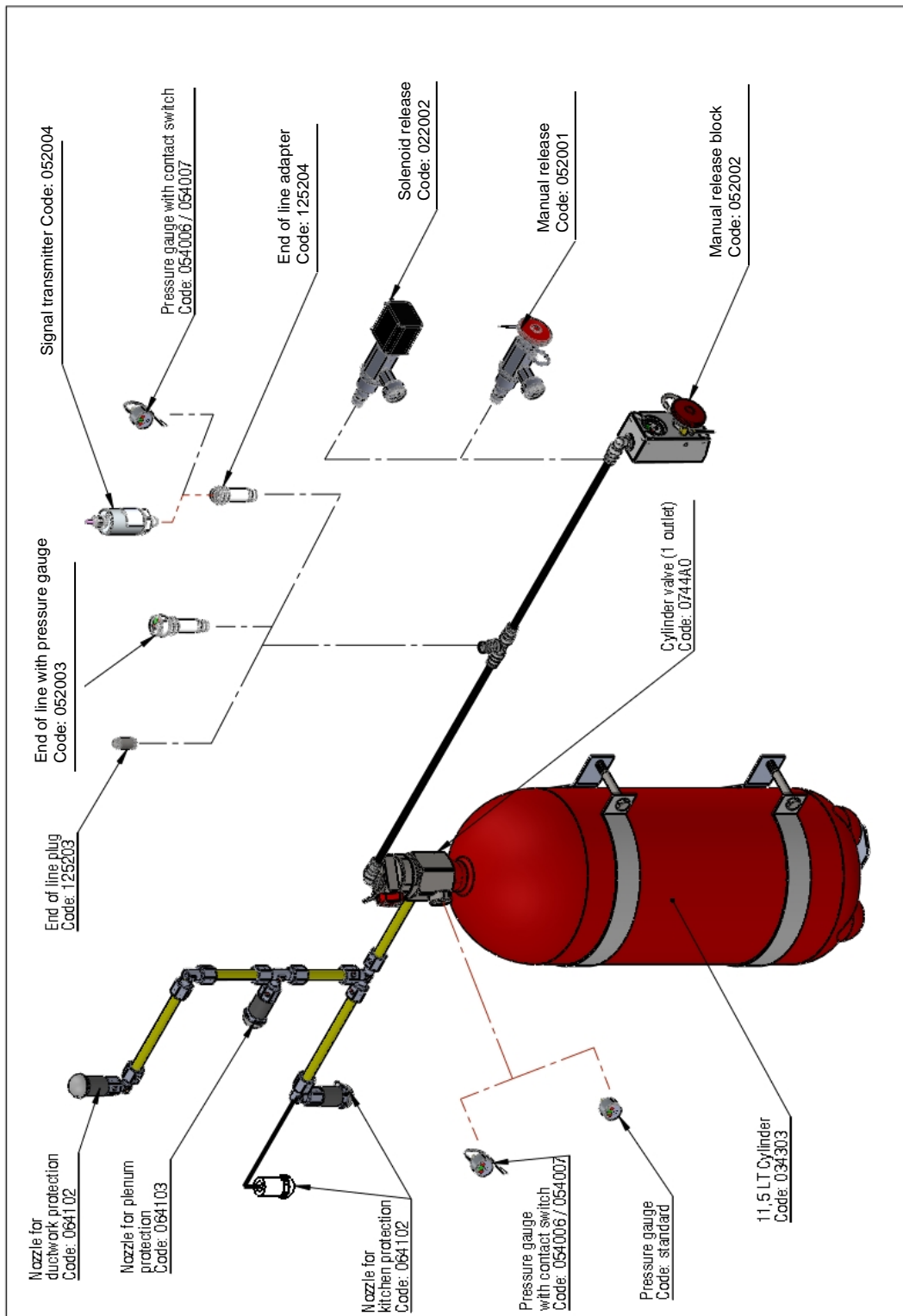


Fig. 15 – Components of System type “Piccolo”

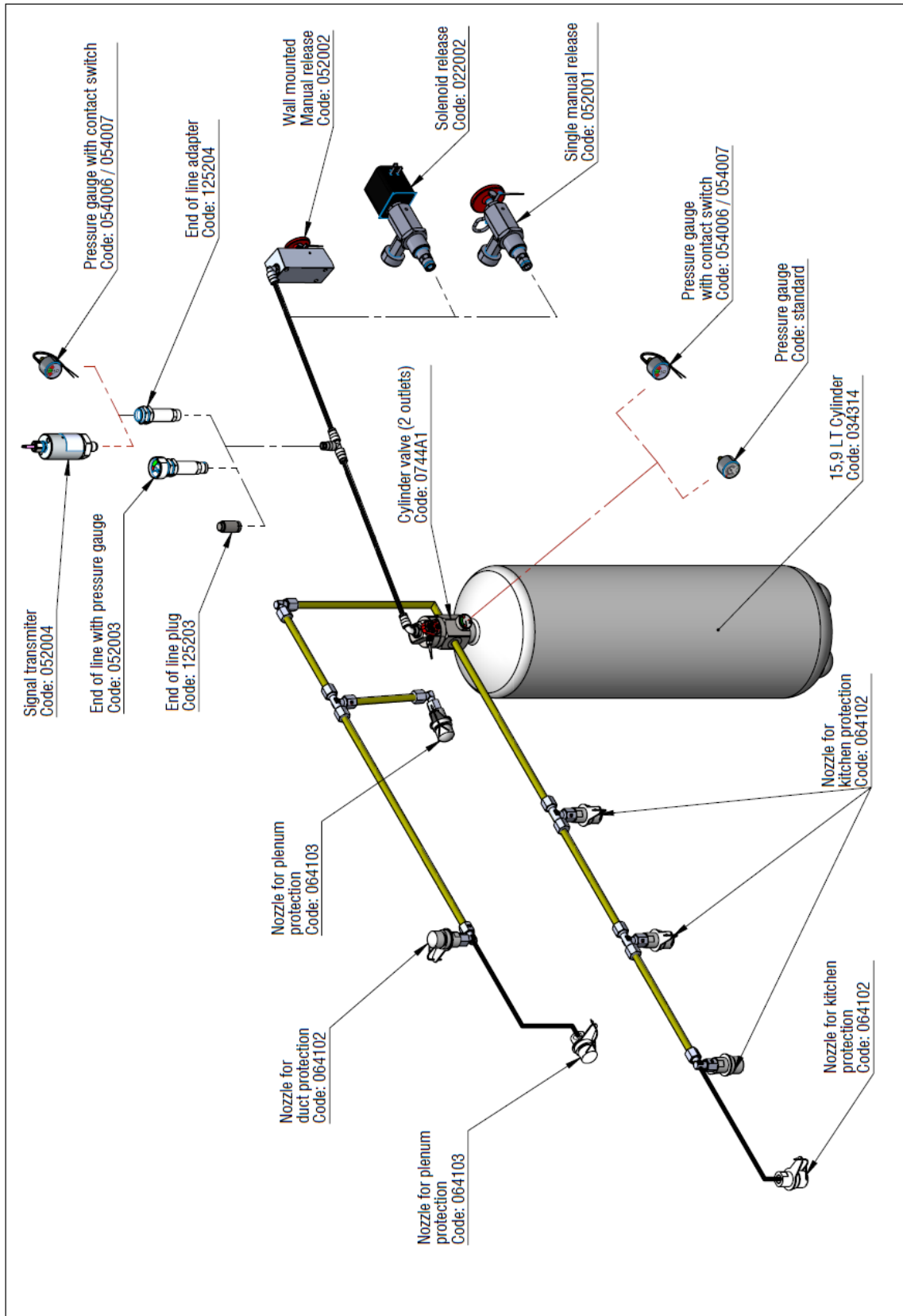


Fig. 16 – Components of System type “Medio” – LPCB approved cylinders

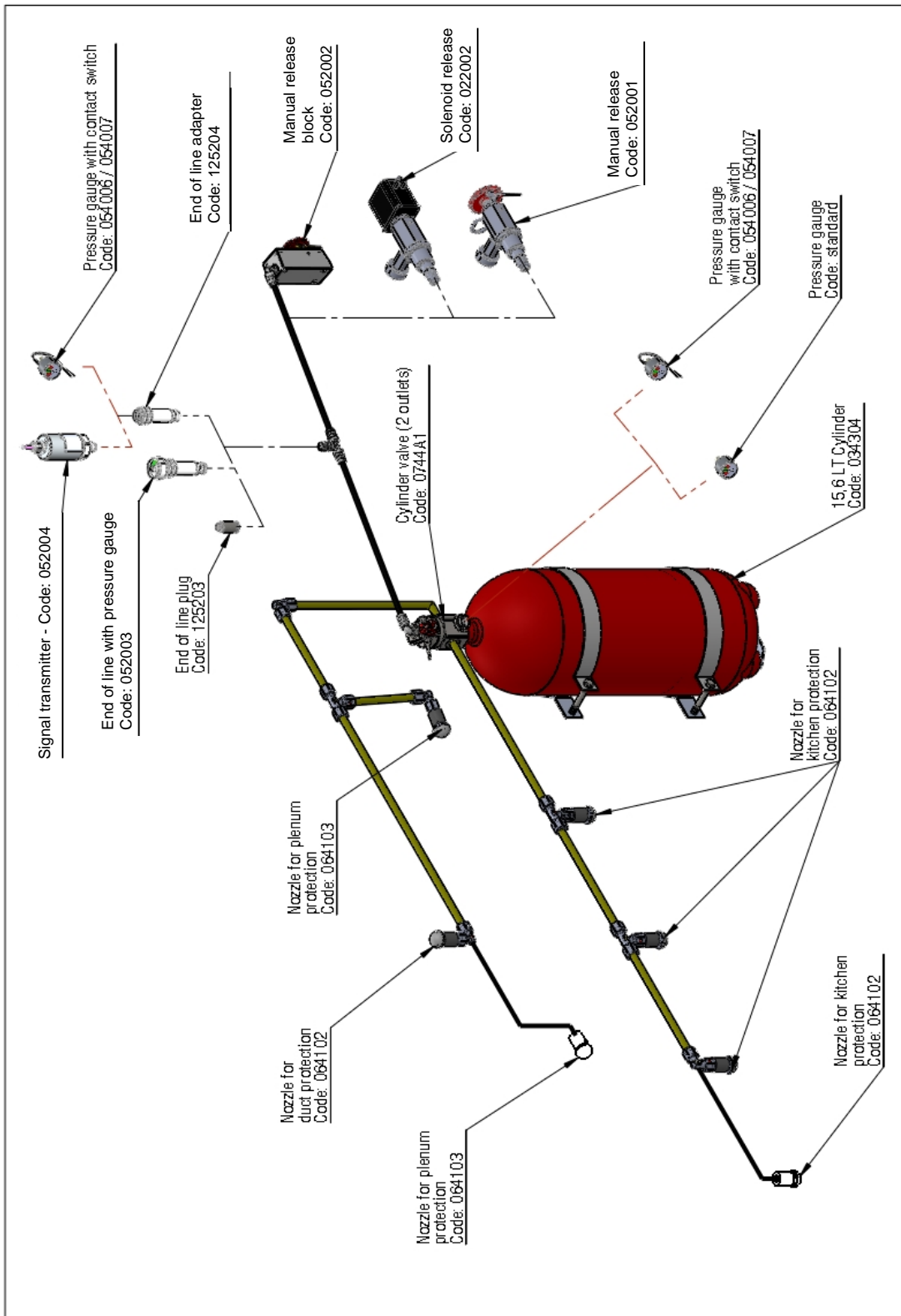


Fig. 17 – Components of System type “Medio”

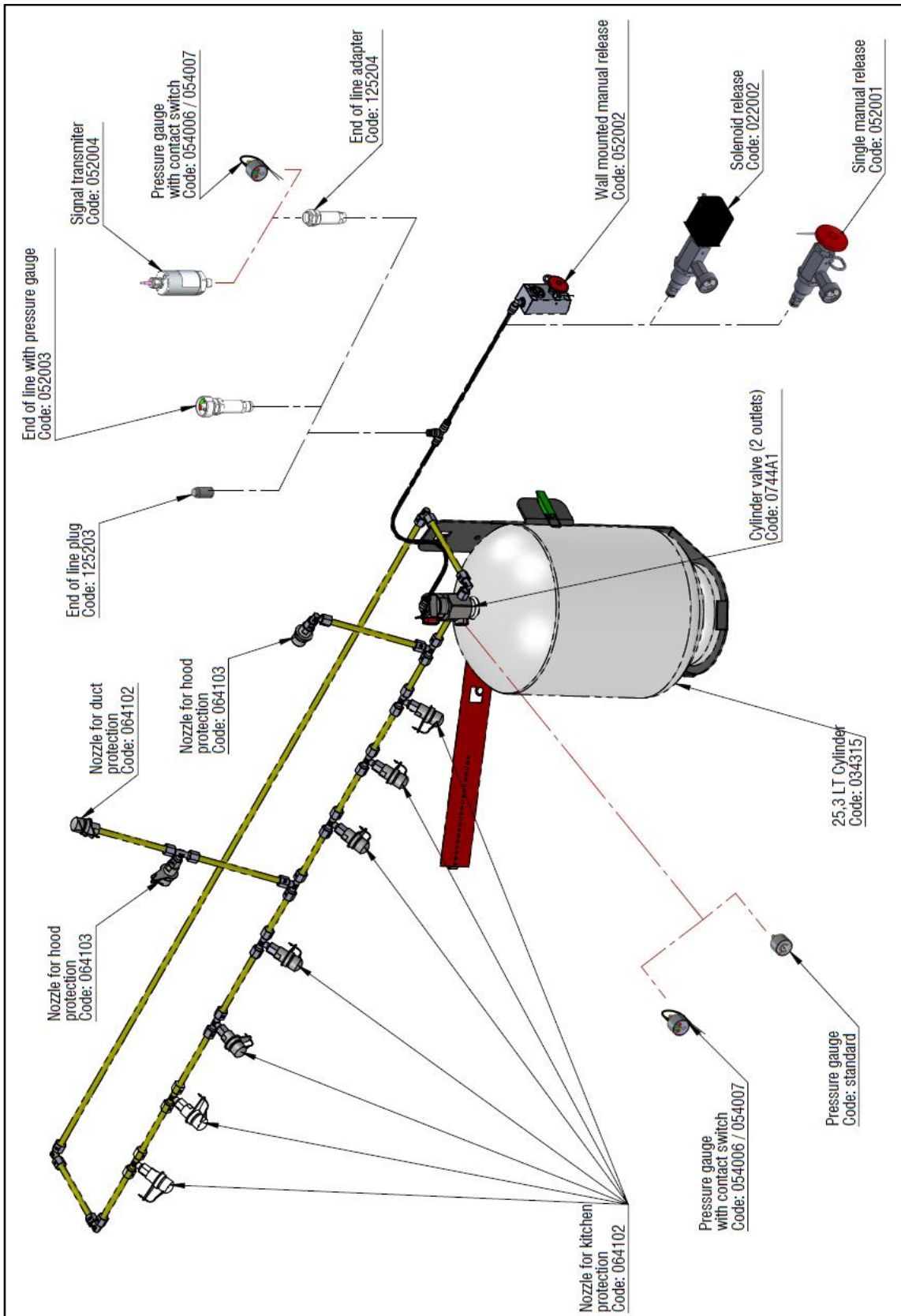


Fig. 18 – Components of System type “Grande” – LPCB approved cylinders

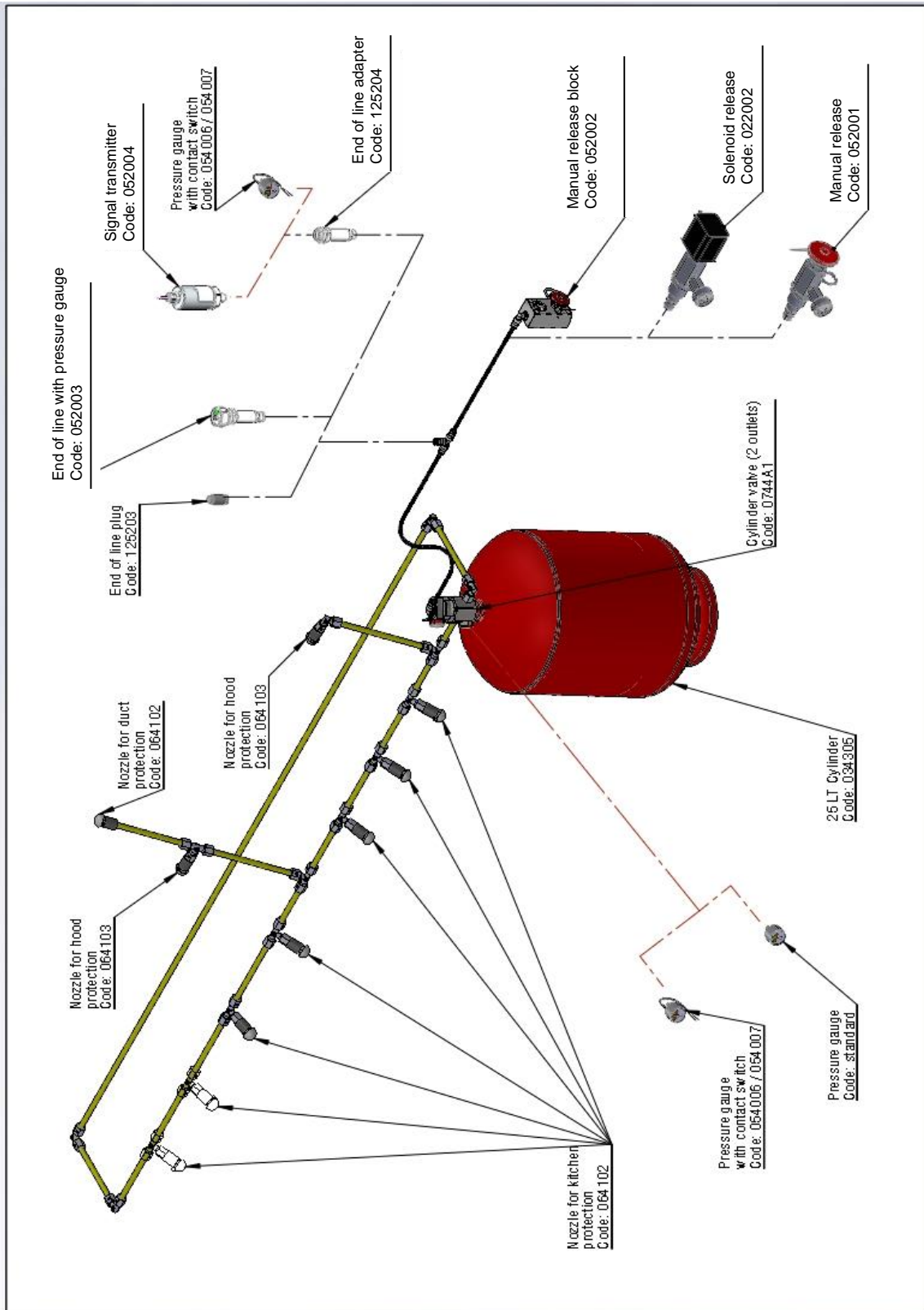


Fig. 19 – Components of System type “Grande”

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