

FM-200 EASY FLOW SYSTEM & FM-200 PISTON FLOW SYSTEM



Engineered Clean Agent Fire Extinguishing System

Owner's Manual



LISTED LISTED EX15719

Clean Agent Extinguishing System Unit



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2016.04

Printed in Korea

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GENERAL INFORMATION

This manual is provided to assist you in the proper operation and maintenance of your FM-200 EFS (FM-200 Easy Flow System) and FM-200 PFS (FM-200 Piston Flow System) engineered clean agent fire extinguishing system manufactured by Masteco Industry, Co., Ltd.

NOTE:

This manual is NOT intended as a detailed design, installation, operation, and maintenance (DIOM) manual (M/N.: MM-FM200-01). Please contact your authorized FM-200 EFS & PFS distributor for all service, repairs or maintenance and additional information.

FM-200 EFS & PFS

Description

FM-200 Easy Flow System is developed for total flooding automatic gaseous fire extinguishing system. FM-200 EFS utilizes clean and safe fire extinguishing agent heptafluoropropane (HFC-227ea) popularly known by its trade name FM-200. Since the enforcement of Montreal Protocol in 1989, FM-200 has been developed and became widely regarded as one of the most cost-effective replacement for Halon 1301 as fire extinguishing agent. In FM-200 EFS, the agent is stored in cylindrical storage container and pressurized with Nitrogen to about 25 bar. This kind of system is also commonly known as standard flow system.

Conventional installation of the clean agent FM-200-based fire extinguishing system is constrained by the size of protected area and distance for agent delivery. This is due to the fact that for such protected area, the quantity of agent becomes insufficient for fire extinguishing when FM-200 agent and the propelling Nitrogen are contained in a single cylinder and pressurized to about 25 bar. To overcome this limitation, in 1998 Masteco Industry, Co., Ltd. started the development of FM-200 PFS in which a separate cylinder is added to contain the Nitrogen. The two cylinders are interconnected by suitable pipes and valves such that during discharge the high-pressure Nitrogen superpressurizes and pushes the extinguishing agent like a gas piston in order to sustain the required pressure and agent mass flow rate. This configuration enables the system to discharge more than 95% of the extinguishing agent over a wider protected area requiring longer agent flow distances within 10 seconds.

All FM-200 EFS & PFSs are designed in accordance with NFPA 2001, Standard on Clean Agent Extinguishing Systems. A typical FM-200 EFS & PFS is illustrated in Figure 1, 2

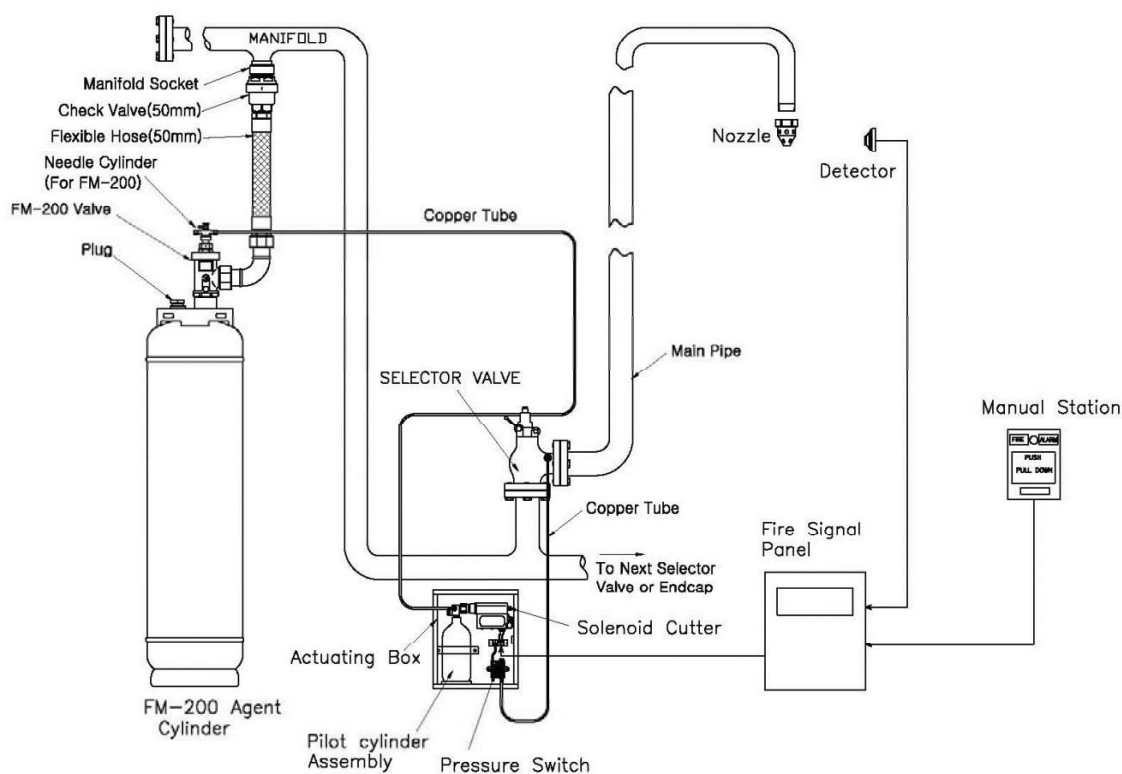


Figure 1. Schematic of a typical FM-200 EFS.

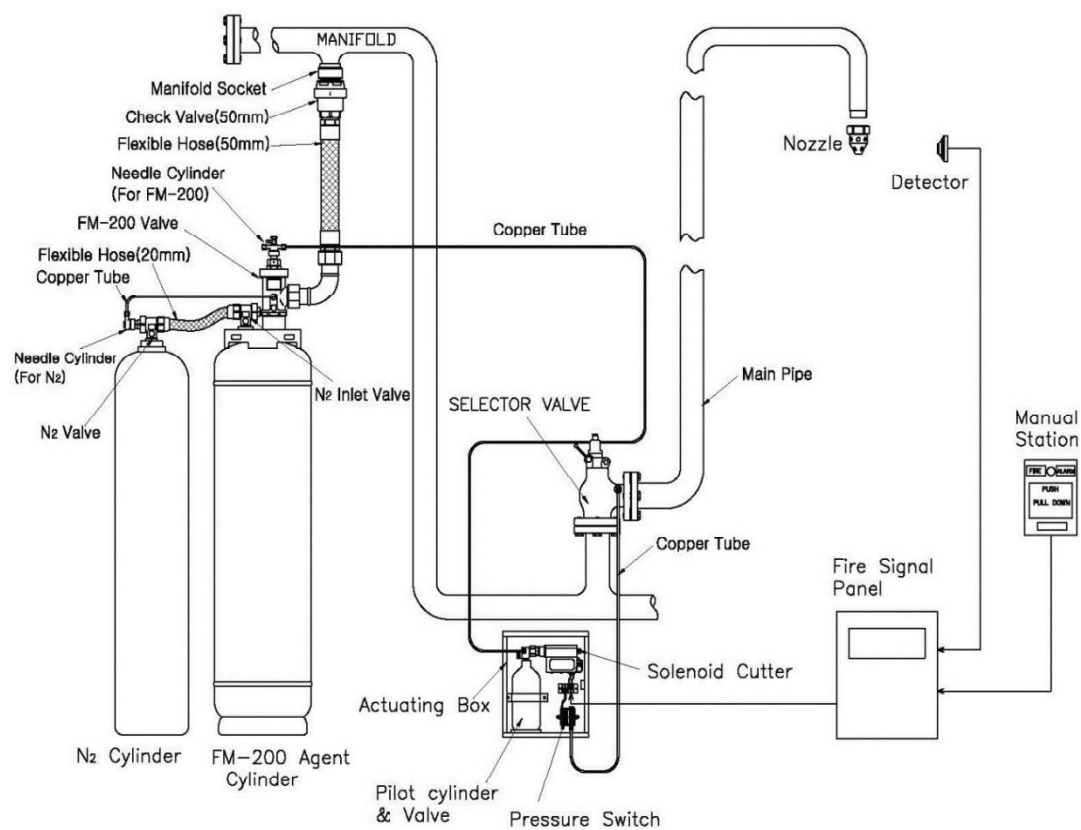


Figure 2. Schematic layout of a typical FM-200 PFS

Application

FM-200 EFS & PFS are designed for the protection of areas where the following classes of fires may occur:

- **Class A fires** - involve ordinary combustibles such as paper, wood, cloth, and rubber.
- **Class B fires** - involve flammable liquids and gases such as gasoline, oil, grease, paint, etc.
- **Class C fires** - involve energized electrical equipment such as motors, generators, and other appliances.

FM-200 EFS & PFS is suitable for the protection of electrical rooms, computer rooms, communication centers, broadcasting centers, dead rooms, chemical laboratories, hospitals, pharmacies, museums, libraries, bank vaults, among others.

FM-200 AGENT

General Characteristics

FM-200 is highly effective, electrically non-conductive, non-corrosive, low toxicity fire extinguishing agent, and when discharged, leaves no residue in the protected area. It suppresses fire by a combination of heat absorption and chemical reaction that interferes with the flame, preventing the flame from reignition.

FM-200 has zero ozone-depletion potential which makes it a leading environment-friendly and preferred fire extinguishing agent. It is a recommended alternative agent to Halon by Significant New Alternatives Policy (SNAP) of Environmental Protection Agency (EPA), USA. FM-200 is listed by Underwriter's Laboratories (UL) and also approved by Factory Mutual (FM), USA.

Toxicity

FM-200 when use in occupied spaces up to 9% concentration has negligible toxicity and since it does not act by removing oxygen in the fire zone, it poses no oxygen-deprivation hazard.

Exposure

Exposure to FM-200 at the design concentration of 9% is not hazardous to health. However, NFPA 2001 recommends that unnecessary exposure to clean agents is to be avoided. In a very unlikely event where FM-200 PFS should discharge the FM-200 agent unexpectedly into the occupied area, all personnel should evacuate the area immediately.

Decomposition

Decomposition of FM-200 occurs when it is exposed to high temperatures, producing halogen acids. The halogen acids are known to be characterized by unpleasant odor prior to reaching hazardous levels. If FM-200 is discharged in 10 seconds or less, fire is rapidly extinguished, minimizing the formation of by-products.

Other safety considerations

Noise loud enough to cause startling to occupants can be created when the high pressure FM-200 is discharged from the nozzles. However, this sort of noise is unlikely to cause any permanent injury. High velocity discharge of FM-200 can cause substantial objects directly on its path to dislodge and enough turbulence to move unsecured paper and light objects within the protected area. Direct skin contact with the liquid or cold gas FM-200 has chilling effect and possibly cause frostbite. FM-200 when discharged and mixed with humid air may cause minor reduction in visibility for brief period of time due to condensation of water vapor. For additional information, refer to FM-200 material safety data sheet contained in Appendix A.

SYSTEM COMPONENTS & TECHNICAL DATA

Prior to installation, FM-200 PFS is packed and shipped in the form of individual and factory-assembled components. The components of a typically simple FM-200 PFS are illustrated in Figures 2-4. The quantity of these components may vary depending on the capacity and design of your FM-200 PFS.

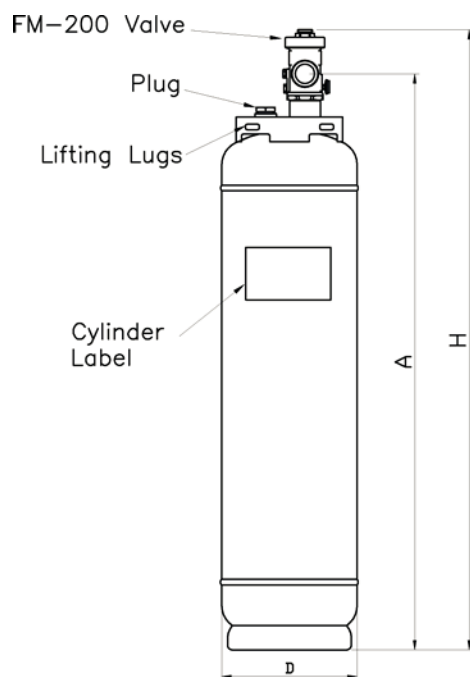
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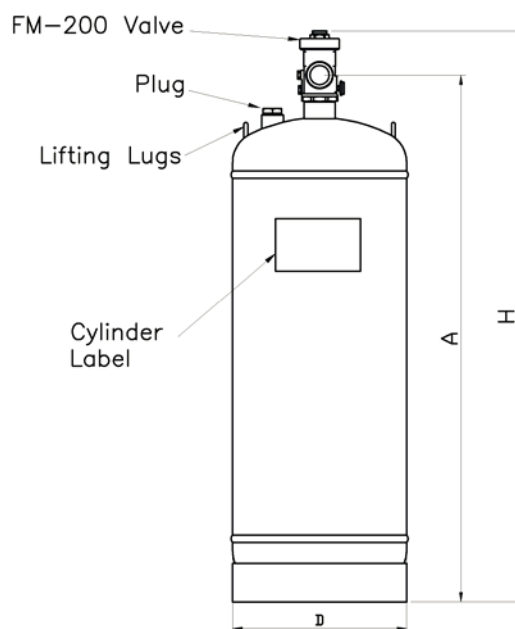
This system is made up of units tested within limitations contained in the detailed installation manual. The system designer must be consulted whenever changes are planned for the system or area of protection. An authorized installer or system designer must be consulted after the system has discharged.

1. FM-200 Container

FM-200 EFS Agent Containers



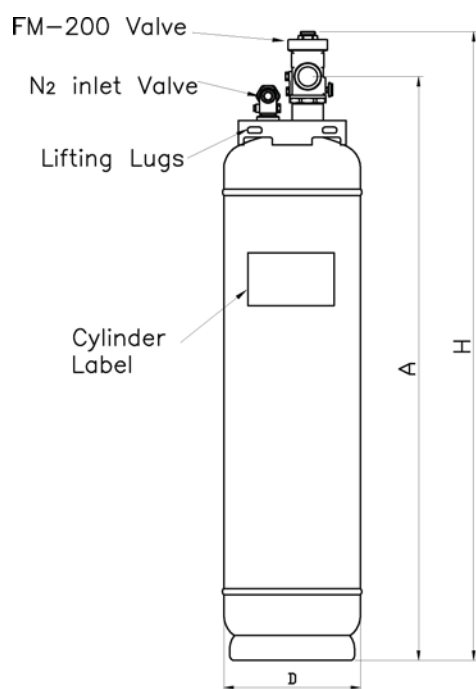
63 L, 89 L and 115.4 L



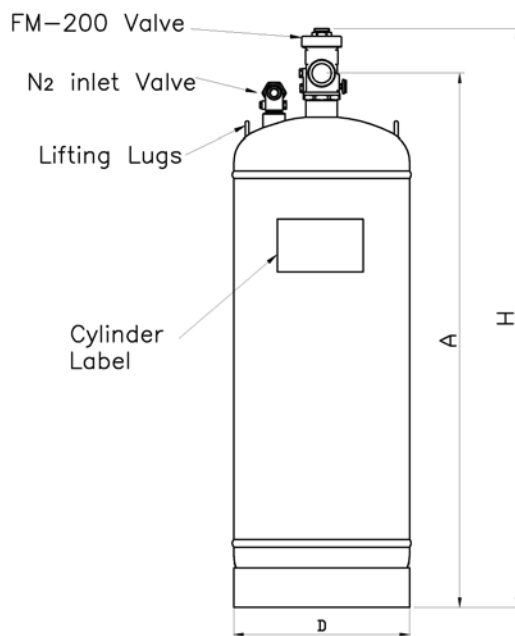
175 L

Model No.	Internal Volume (L)	Fill range (kg)	Dimensions (mm)			Valve Models		Empty Weight (kg)
			D	H	A	FM-200 Discharge	Nitrogen Inlet	
MFC-50	63.0	31.2 - 60.6	350	1005	905	CVL-R40	Plugged	52.9
MFC-75	89.0	44.1 - 85.6	350	1290	1190	CVL-R40	Plugged	66.3
MFC-100	115.4	57.2 - 111.0	350	1610	1495	CVL-R50	Plugged	83.6
MFC-150	175.0	86.7 - 168.3	450	1512	1397	CVL-R50	Plugged	122.2

FM-200 PFS Agent Containers



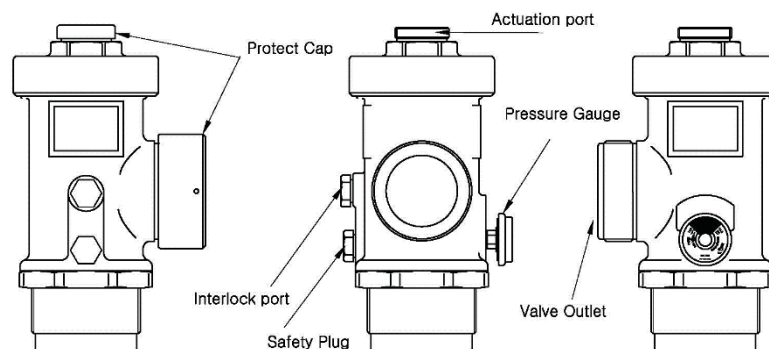
63 L, 89 L and 115.4 L



175 L

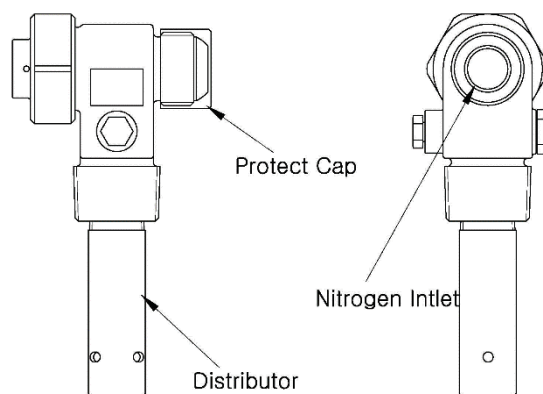
Model No.	Internal Volume (L)	Fill range (kg)	Dimensions (mm)			Valve Models		Empty Weight (kg)
			D	H	A	FM-200 Discharge	Nitrogen Inlet	
MFC-P50	63.0	31.2 - 60.6	350	1005	905	CVL-R40	CVH-F20	53.4
MFC-P75	89.0	44.1 - 85.6	350	1290	1190	CVL-R40	CVH-F20	66.8
MFC-P100	115.4	57.2 - 111.0	350	1610	1495	CVL-R50	CVH-F20	84.1
MFC-P150	175.0	86.7 - 168.3	450	1512	1397	CVL-R50	CVH-F20	122.7

2. FM-200 Discharge Valve



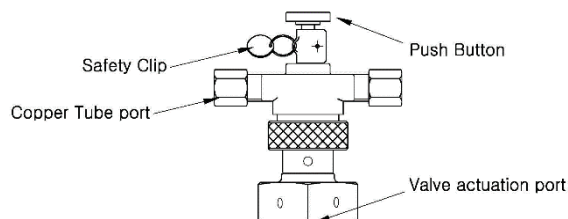
Model No.	Inlet/Outlet Diameter, D (mm)	FM-200 Container	Material	Threaded Connection	Proof Test Pressure (bar)
CVL-R40	40	MFC-50 MFC-75 MFC-P50 MFC-P75	Brass	M60×2.0	69
CVL-R50	50	MFC-100 MFC-150 MFC-P100 MFC-P150	Brass	M70×2.0	

3. FM-200 Nitrogen Inlet Valve



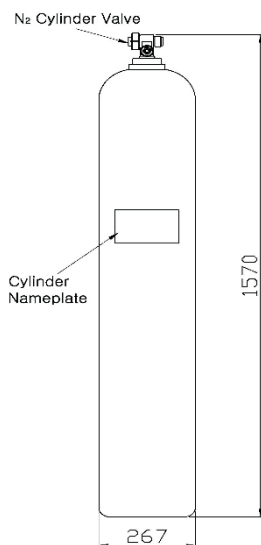
Model No.	Inlet Diameter (mm)	FM-200 Container	Material	Threaded Connection	Proof Test Pressure (bar)
CVH-F20	20	MFC-P50 MFC-P75 MFC-P100 MFC-P150	Brass	M36×2.0	120

4. FM-200 Needle Cylinder



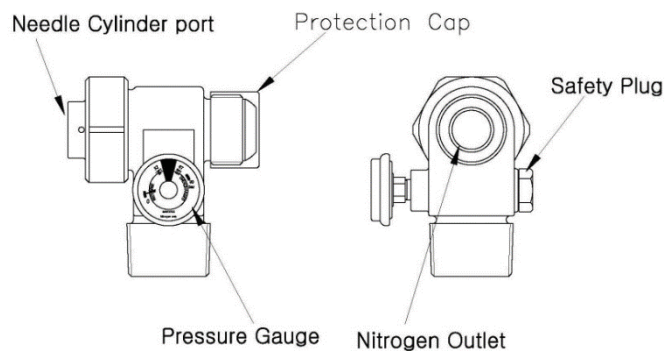
Model No.	Maximum Installation Quantity	FM-200 Discharge Valve	Material	Threaded Connection
MNC-06	30	CVL-R40, CVL-R50	Brass Stainless Steel	M38×1.5

5. Nitrogen Container



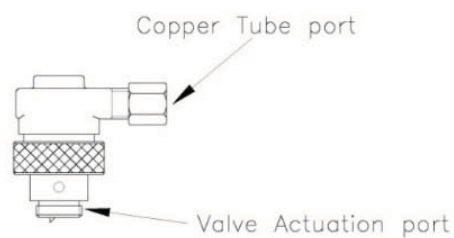
Model No.	Internal Volume (L)	Fill pressure (bar)	Dimensions (mm)		Material	Valves	Empty Weight (kg)	DOT
			D	H				
N68-60	68	N2 60bar	267	1570	MnH Steel	20A	74.5	3AA
N68-70	68	N2 70bar						
N68-80	68	N2 80bar						

6. Nitrogen Valve



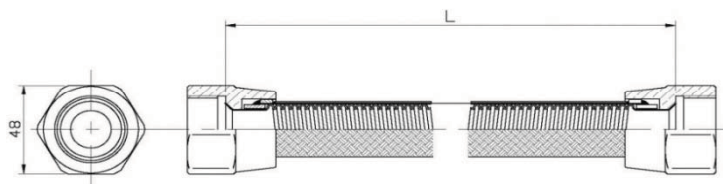
Model No.	Inlet/Outlet Diameter (mm)	Material	Nitrogen Container	Proof Test Pressure (bar)
CVH-N20	20	Brass	NC-68	120

7. Nitrogen Needle Cylinder



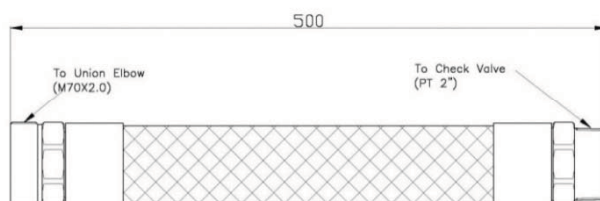
Model No.	Nitrogen Discharge Valve	Material	Threaded Connection
MNN-06	CVH-N20	Brass	M18x1.5

8. Flexible Hose (20A)



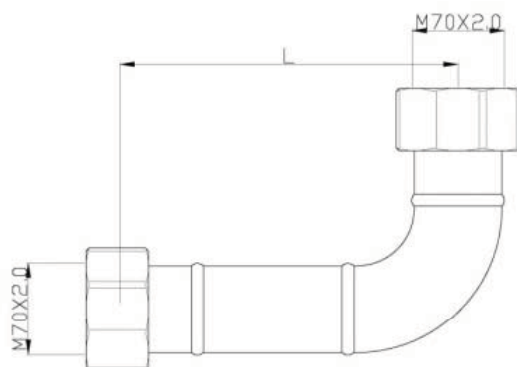
Model No.	Length (mm)	Material	Minimum Bending Radius (mm)	Threaded Connection	Proof Test Pressure (bar)
MFH-206	600	Brass Stainless Steel	75	M36x2.0	120
MFH-207	700				
MFH-209	900				

9. Flexible Hose (50A)



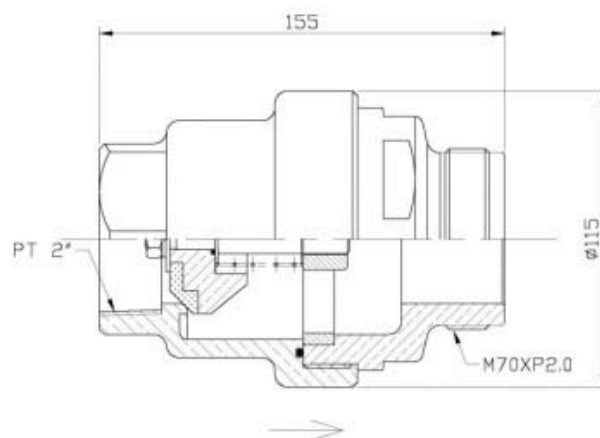
Model No.	Length (mm)	Material	Minimum Bending Radius (mm)	Threaded Connection	
MFH-50	500	Brass Stainless Steel EPDM	350	Elbow side	Check Valve side
				M70x2	PT 2" (50A)

10. Union Elbow



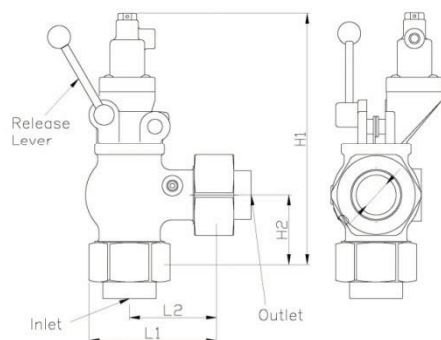
Model No.	Length, L (mm)	Material	Diameter Inlet/Outlet (mm)	Thread Connection
MUE-501	125	Brass Stainless Steel	50	M70x2.0
MUE-502	225		50	

11. 50A Check Valve

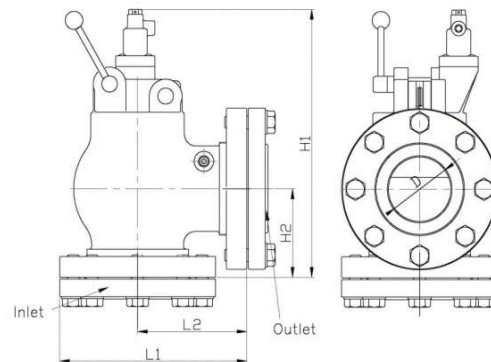


Model No.	Diameter Inlet/Outlet (mm)	Material	Flexible Hose Connect	Welding Socket Connect	Proof Test Pressure (bar)
MCV-50	50	Brass	PT 2"	M70x2	69

12. Selector Valve



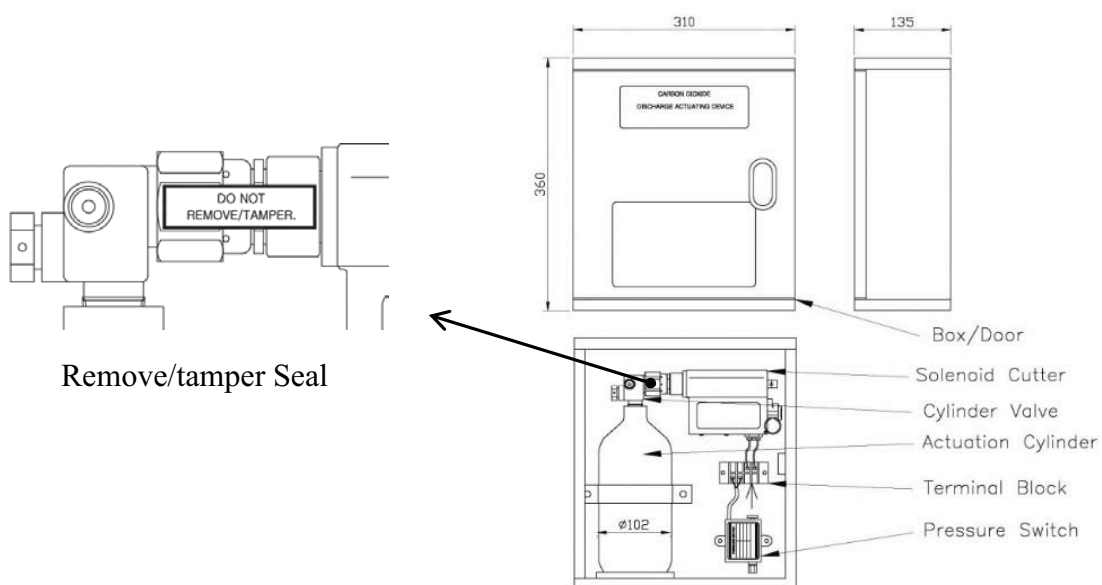
MSV-32, MSV-40
Union by Welded Connection



MSV-32, MSV-40, MSV-50, MSV-65,
MSV-80, MSV-100, MSV-125, MSV-150
Union by Bolted Flange Connection

Model No.	Diameter Inlet/Outlet (mm)	L1	L2	H1	H2	Material	Proof Test Pressure (bar)	Union Connector
MSV-32	32	142	90	249	70	Bronze Casting Brass Carbon Steel	69	Welding & Union Threaded
MSV-40	40	142	90	249	70			
MSV-50	50	190	110	247	68			
MSV-65	65	215	125	286	85			
MSV-80	80	240	140	328	110			
MSV-100	100	288	175	396	135			
MSV-125	125	350	200	438	158			
MSV-150	150	395	230	461	168			

13. Actuation Box (Releasing Device)



Model No.	Dimension (mm)	Cylinder Internal Volume (L)	Components	Total Weight(kg)
MAB-C1	360x310x135	1.1	Pilot Cylinder Assembly Solenoid Cutter Pressure Switch Terminal Box	10

Solenoid Cutter

Model No.	Dimension (mm)	Power Supply Rating
MSC-01	113x172x45	24 Vdc, 1.7A

Pilot Cylinder

Model No.	Dimension (mm)	Mateal	Internal Volume (L)	Fill Capacity (kg)	Proof Test Pressure (bar)
MAC-01	Ø102x260	MnH Steel	1.1	0.7 (CO ₂)	212

listed) Pressure switch (Not UL - Option

Model No.	Dimension (mm)	Power Supply Rating
MPS-01	-	24 Vdc, 3A

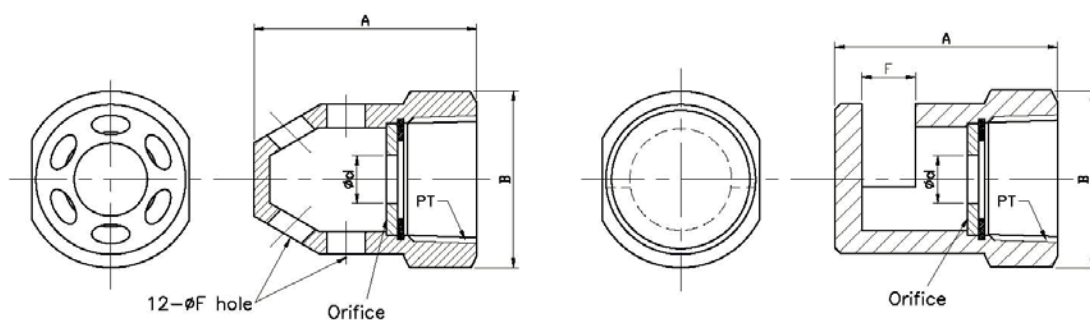
14. Pressure Switch

Model No.	Manufacturer	Out. Dimension (mm)	Contact Setting Pressure(psi)	Proof Pressure(psi)
PIX-B30	BARKSDALE	118 x 131 x 68	1.5 ~ 30	2,000

UL listed Pressure switch – for use in Hazardous Locations E158638

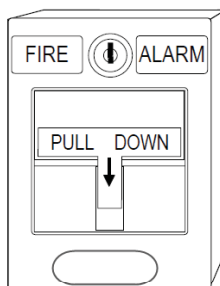
FM-200 EFS & PFS requires the use of UL Listed pressure switch for use in hazardous location that is compatible with the system operating pressure and the discharge or fire alarm panel.

15. Discharge Nozzle



Nominal Size	PT	A	B	F(360°)	F(180°)	Orifice Diameter, <i>d</i>	Material
15A	1/2"	45	32	5	10	See Parts List.	Brass Ni/Cr Plating
20A	3/4"	50	38	8	12		
25A	1"	58	46	10	14		
32A	1 1/4"	68	58	12	16		
40A	1 2/3"	74	63	14	18		
50A	2"	84	75	16	20		

16. Manual Station



***NOTE:**

Any UL listed manual station for releasing application that is compatible with the control panel may be installed with FM-200 EFS & PFS per design specification. Your designer must refer to the control panel manual for compatibility information.

CONTAINER LABEL

EASY FLOW SYSTEM

FM-200®

FIRE EXTINGUISHING AGENT

THIS CONTAINER CONTAINS FM-200® (HFC-227ea) SUPERPRESSURIZED WITH NITROGEN TO 25 BAR AT 21°C.

MODEL NO.:

TARE WEIGHT: KG

AGENT WEIGHT: KG

GROSS WEIGHT: KG

YEAR OF MANUFACTURE:

USE AT TEMPERATURE RANGE OF 0°C TO 54°C.

OPERATING PRESSURE OF 25 BAR AT 21°C.

FACTORY TESTED AT PRESSURE OF 1000 PSI (69 BAR). DOT 4BW500 COMPLIANT.

HAZARDOUS MATERIAL IDENTIFICATION

FM-200® (HFC-227ea)	
HEALTH	1
FLAMMABILITY	0
PHYSICAL HAZARD	0
PERSONAL PROTECTION*	

MISUSE OR INTENTIONAL INHALATION ABUSE MAY LEAD TO DEATH WITHOUT WARNING. RAPID EVAPORATION OF THE LIQUID MAY CAUSE FROSTBITE.

*RATING TO BE SUPPLIED BY USER DEPENDING ON USE CONDITIONS. FOR ADDITIONAL INFORMATION, REFER TO FM-200® MSDS FROM DUPONT, 1007 MARKET STREET, WILMINGTON, DE 19898, 1-800-441-7515 (OUTSIDE THE U.S. 1-302-774-1000).

OPERATION

WHEN CONNECTED TO THE SYSTEM, THIS CONTAINER IS OPERATED AUTOMATICALLY VIA PRESSURE-ACTUATED DEVICE.

INSPECTION AND MAINTENANCE

MONTHLY

- CHECK THE CONTAINER PRESSURE GAUGE FOR PROPER PRESSURE. IF THE PRESSURE (ADJUSTED FOR TEMPERATURE CORRECTION) SHOWS A LOSS OF MORE THAN 10%, REFILL OR REPLACE THE CONTAINER.
- INSPECT THE VALVES, PRESSURE GAUGES, AND SAFETY PLUGS FOR ANY SIGN OF DAMAGE. IF ANY DAMAGE IS FOUND, REPLACE THE CONTAINER.

SEMI-ANNUALLY

- CHECK AGENT QUANTITY AND PRESSURE IN FM-200 CONTAINER. IF AGENT QUANTITY SHOWS A LOSS OF MORE THAN 5% OR CONTAINER PRESSURE (ADJUSTED FOR TEMPERATURE CORRECTION) SHOWS A LOSS OF MORE THAN 10%, REFILL OR REPLACE THE CONTAINER.
- REFER TO THE SYSTEM INSTALLATION, OPERATION, AND MAINTENANCE MANUAL PART NO. MM-FM200-01 AND THE STANDARD ON CLEAN AGENT FIRE EXTINGUISHING SYSTEMS, NFPA 2001 FOR MORE RELATED INFORMATION.

CAUTION

- TRANSPORT, STORE, AND INSTALL THE CONTAINER IN VERTICAL POSITION ONLY. AVOID EXPOSURE TO DIRECT SUNLIGHT.
- ACCIDENTAL AGENT DISCHARGE COULD CAUSE SEVERE PERSONAL INJURY OR DEATH. ENSURE THAT ALL PROTECTION CAPS AND THREADED SAFETY PLUGS ARE INSTALLED FIRMLY TO THE VALVES WHEN THE CONTAINER IS NOT CONNECTED TO THE SYSTEM.

WARNING


The discharge of clean agent systems to extinguish a fire can result in a potential hazard to personnel from the natural form of the clean agent or from the products of combustion that result from exposure of the agent to the fire or hot surfaces. Unnecessary exposure of personnel either to the natural agent or to the products of decomposition shall be avoided.

RECYCLING PROTECTS THE ENVIRONMENT. DO NOT DISPOSE. DISCHARGE ONLY IN CASE OF FIRE.

IF CONTAINER CONTENTS MUST BE REMOVED FOR SERVICE, MAINTENANCE OR DISMANTLING OF THE CLEAN AGENT SYSTEM - PRIOR TO REMOVAL, CONTACT YOUR LOCAL INSTALLER OR MANUFACTURER FOR INSTRUCTIONS ON HANDLING EQUIPMENT AND RECLAIMING OR RECYCLING CLEAN AGENT.

DO NOT COVER, REMOVE OR DEFACE THIS LABEL.

MASTECO INDUSTRY CO., LTD.
715-12, GOJAN-DONG, NAMDONG-GU, INCHEON, 405-821, KOREA
TEL. NO. +82-32-811-1301
FAX NO. +82-32-814-1301



LISTED LISTED EX15719

Clean Agent Extinguishing System Unit

EASY FLOW SYSTEM

PISTON FLOW SYSTEM

FM-200®

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CAUTION

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DO NOT COVER, REMOVE OR DEFACE THIS LABEL.

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715-12, GOJAN-DONG, NAMDONG-GU, INCHEON, 405-821, KOREA
TEL. NO. +82-32-811-1301
FAX NO. +82-32-814-1301



LISTED LISTED EX15719

Clean Agent Extinguishing System Unit

PISTON FLOW SYSTEM

PISTON FLOW SYSTEM NITROGEN

FM-200® AGENT PROPELLANT

THIS CONTAINER CONTAINS COMPRESSED NITROGEN GAS INTENDED FOR DISCHARGING FM-200® FIRE EXTINGUISHING AGENT.

MODEL NO.:

OPERATING PRESSURE AT 21°C: BAR

DESIGNED FOR USE WITH
FM-200® CONTAINER MODEL NO.:

TARE WEIGHT: KG

NITROGEN GAS WEIGHT: KG

GROSS WEIGHT: KG

YEAR OF MANUFACTURE:

USE AT TEMPERATURE RANGE OF 0°C TO 54°C.

FACTORY TESTED AT PRESSURE OF 1000 PSI (69 BAR).
DOT 3AA COMPLIANT.

HAZARDOUS MATERIAL IDENTIFICATION

NITROGEN GAS	
HEALTH	0
FLAMMABILITY	0
PHYSICAL HAZARD	0

MORE INFORMATION ON COMPRESSED NITROGEN GAS HANDLING AND SAFETY ARE AVAILABLE FROM THE MANUFACTURER, KOREA TANSAN, 410-10 DAIYA-DONG, SIHEUNG-SI, GYEONGGI-DO, KOREA (TEL. +82-31-314-2496)

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MONTHLY

CHECK THE CONTAINER PRESSURE GAUGE FOR PROPER PRESSURE. IF THE PRESSURE (ADJUSTED FOR TEMPERATURE CORRECTION) SHOWS A LOSS OF MORE THAN 10%, REFILL OR REPLACE THE CONTAINER.

SEMI-ANNUALLY

- CHECK AGENT QUANTITY AND PRESSURE IN FM-200 CONTAINER. IF AGENT QUANTITY SHOWS A LOSS OF MORE THAN 5% OR CONTAINER PRESSURE (ADJUSTED FOR TEMPERATURE CORRECTION) SHOWS A LOSS OF MORE THAN 10%, REFILL OR REPLACE THE CONTAINER.
- REFER TO THE SYSTEM INSTALLATION, OPERATION, AND MAINTENANCE MANUAL PART NO. MM-FM200-01 AND THE STANDARD ON CLEAN AGENT FIRE EXTINGUISHING SYSTEMS, NFPA 2001 FOR MORE RELATED INFORMATION.



WARNING


WHEN RELEASED, CAN CAUSE SUFFOCATION BY LOWERING OXYGEN CONTENT IN AIR AVAILABLE FOR BREATHING. INHALATION OF VERY HIGH CONCENTRATIONS CAN CAUSE DIZZINESS, UNCONSCIOUSNESS, OR DEATH.

Avoid exposure to vapors, fumes, and products of combustion.

IF CONTAINER CONTENTS MUST BE REMOVED FOR SERVICE, MAINTENANCE OR DISMANTLING OF THE CLEAN AGENT SYSTEM – PRIOR TO REMOVAL, CONTACT YOUR LOCAL INSTALLER OR MANUFACTURER FOR INSTRUCTIONS ON HANDLING EQUIPMENT AND RECLAIMING OR RECYCLING NITROGEN GAS.

DO NOT COVER, REMOVE OR DEFACE THIS LABEL.



MASTECO INDUSTRY CO., LTD.
 715-12, GOJAN-DONG, NAMDONG-GU,
 INCHEON, 405-821, KOREA
 TEL. NO. +82-32-811-1301
 FAX NO. +82-32-811-1301

PISTON FLOW SYSTEM

INSTALLATION

The installation of FM-200 EFS & PFS is based on the requirements of NFPA 2001, Standard on Clean Agent Extinguishing Systems, 2015 Edition.

WARNING! FM-200 EFS & PFS must be installed and operated by qualified and trained professionals who must refer to the detailed DIOM manual (MM-FM200-01). Please contact your authorized distributor for additional information.



Post-Installation Check

When the installation of FM-200 EFS or PFS has been completed, perform the following check to ensure that all system components have been properly installed and in strict compliance with the instructions in this manual:

- Check if the installed FM-200 container and Nitrogen container (*only for FM-200 PFS) have the correct weight and pressure as specified in the system installation drawing.
- Ensure that the containers are firmly secured within the brackets and frames.
- Inspect the agent distribution piping network for compliance with the system drawings.
- Check that the manifold and piping are securely fastened to the hangers.
- Check if agent distribution piping network is thoroughly cleaned free from dust, oil, and other foreign objects.
- Check that the check valve is properly installed and in accordance with the system drawing.
- Ensure that the nozzles installed have the correct location and model numbers as specified in the system drawing.
- Confirm that the manual station is properly installed at accessible location.

If any discrepancy in the installation is found, contact your authorized system installer or distributor.

OPERATION

In FM-200 EFS, FM-200 is contained in FM-200 container fitted with FM-200 discharge valve. When the FM-200 discharge valve is activated, Nitrogen gas at 25 bar (21°C) on the vapor space of the FM-200 container drives the liquid FM-200 agent out of the container through the discharge valve and into the piping system. Subsequently, the liquid FM-200 agent reaches the discharge nozzle(s) where it is released into the protected area and instantly vaporizes in air.

In FM-200 PFS, FM-200 is contained in FM-200 container fitted with FM-200 discharge valve and Nitrogen inlet valve. The Nitrogen gas is contained in a separate high-pressure

cylinder fitted with high-pressure Nitrogen valve. When the FM-200 discharge valve is activated, liquid FM-200 is pushed out of its container due to superpressurization. At the same instant, the discharged FM-200 is used to activate the Nitrogen discharge valve. The high-pressure Nitrogen gas enters the vapor space of FM-200 container for continuous superpressurization and push of the FM-200 out of the container through the cylinder discharge valve and into the agent distribution piping system. Through the discharge nozzle(s), FM-200 agent is released into the protected area and instantly vaporizes in air.

NOTE!


If FM-200 EFS or PFS has discharged, please inform your authorized distributor and perform the related procedures specified by the authorities having jurisdiction.

Automatic Operation

With all components fully functional and installed as outlined in the DIOM manual, FM-200 EFS or PFS is operated automatically through detection and control system. The series of events are outlined as follows:


1. Upon detection, the control panel sends electrical signal that triggers the solenoid cutter (releasing device) in the actuation box.
2. The pilot cylinder valve is actuated by the energized solenoid cutter (releasing device), enabling the discharge of pressurized actuation gas into the actuation copper tube lines.
3. The selector valve is opened by the flowing pressurized actuation gas.
4. Pressure from the flowing actuation gas is used to actuate the FM-200 needle cylinder, opening the FM-200 discharge valve and allowing FM-200 to be discharged.
5. The discharged FM-200 flows out of the container through the discharge valve and into the Nitrogen actuation tube, actuating the Nitrogen needle cylinder and subsequently opening the Nitrogen valve (for FM-200 PFS only).
6. The high-pressure Nitrogen enters the FM-200 container via the Nitrogen inlet valve, pressurizing the liquid FM-200 (for FM-200 PFS only).
7. Pressure from the discharged FM-200 is used to actuate the pressure switch via the pressure switch actuation tube as the agent flows through the selector valve. The actuated pressure switch enables the activation of discharge alarm.
8. The discharged FM-200 flows through the distribution piping system, through the nozzles and finally to the protected area where the liquid FM-200 quickly turns into vapor.

The operating temperature range for FM-200 EFS & PFS is 0-55°C.

CAUTION!  The calculation method was evaluated for a temperature range of $21^{\circ}\text{C} \pm 5.5^{\circ}\text{C}$. When the piping network and container storage temperature is outside this range, there is a risk that the system will not supply the designated amount of extinguishing agent.

Manual Operation via the Manual Station

1. Proceed to the manual station.
2. Ensure that all personnel have evacuated the protected area.
3. Operate the manual station by following the operating instructions stamped on the body of the device.

CAUTION!  All manual operating procedures for system actuation should **ONLY** be performed in case of emergency as the last sort of action.

INSPECTION AND MAINTENANCE

A regular and systematic inspection and maintenance program must be created. The inspection and maintenance schedule specified therein should be followed strictly to ensure proper operation of FM-200 EFS & PFS.

NOTE!



The system shall be periodically inspected by trained personnel.

Weekly

Hazard or Protected Area

Check that the hazard or protected areas are free from obstruction, and that easy access to the manual station and actuation box is maintained. Also check that there are no changes in protected area based on the original layout that might affect system performance such as the configuration and contents of area, openings, and floor or ceiling voids.

System Components

Perform visual check of the system components, distribution piping and nozzles. Check the immediate surroundings of the equipment for any sign of damage or modification.

Monthly Maintenance

Needle Cylinders

Check that the needle cylinders are intact and free from any signs of physical deterioration such as corrosion and cracks. Confirm that safety clip of the PUSH button is secure fastened. If damage is found replace the needle cylinder.

FM-200 and Nitrogen Container Assemblies

Check the containers for any sign of damage or unauthorized modification. Check the valves, pressure gauges, and safety plugs for any sign of damage. If any damage is found, replace the container.

Check FM-200 container pressure gauge for proper pressure. The nominal pressure should be 24.8 bar at 21°C. However, the pressure will vary with temperature as shown in Table 1. If the pressure (adjusted for temperature correction) shows a loss of more than 10%, refill or replace the container. Contact your authorized distributor for charging assistance.

Table 1 FM-200 container pressure variation with respect to temperature

Temp. (°C)	Pressure (bar)
0	19.9
4	20.9
10	22.1
16	23.4
21	24.8
27	26.2
32	27.7
38	29.3
43	31
49	32.8
54	34.6

Container fixtures

Check the container frames and brackets for loose fasteners or broken parts. Inspect for any sign of damage. If any parts are loose or damaged, replace immediately.

Flexible Hoses

Check the flexible hoses for leaks or any signs of damage. Verify that the threaded

connections are securely tightened. If any parts are loose or damaged, replace immediately.

Actuation Copper Tube Lines

Check all actuation copper tube lines (FM-200 actuation tube, Nitrogen actuation tube, selector valve actuation tube, and pressure switch actuation tube) for any signs of damage, and loose fittings. Tighten loose fittings and replace damaged components.

Discharge Nozzles

Check all discharge nozzles for dirt and any signs of damage. Replace damaged nozzle and make sure that the replacement part bears the same model number.

Manual Station

Check manual station for any signs of damage and dirt. If any damage is found, replace the manual station.

Pressure switch

Check pressure switch for any signs of damage and dirt. If any damage is found replace the pressure switch.

Semi-Annual Maintenance

FM-200 Container

Check agent quantity and pressure in FM-200 container. If agent quantity shows a loss of more than 5% or container pressure (adjusted for temperature correction; refer to Table 1) shows a loss of more than 10%, refill or replace the container.

Post-discharge maintenance

After FM-200 EFS or PFS has discharged, the FM-200 and Nitrogen containers need to be recharged or disposed and replaced depending on the year of manufacture. Additionally, the rupture discs in valves must be replaced. Refer to the DIOM (M/N: MM-FM200-01) for a detailed charging instructions and procedures in replacing the rupture discs. See the Parts List for ordering information. Once all components have been re-installed system reset (solenoid cutter, control panel, and manual pull) and actuation test must be performed as outlined in FM-200 DIOM. Contact your authorized distributor for assistance.

NOTE!



Carefully check the FM-200 containers year of manufacture prior to charging. Retest of containers maybe required in accordance with NFPA 2001 and DOT 4BW500.

PARTS LIST

The following shows the complete list of available components for use with FM-200 EFS & PFS.

Model Description	Model No.
FM-200 CONTAINER (Assembly)	
63 L cylinder factory-fitted with FM-200 discharge valve 40A and Plug	MFC-50
89 L cylinder factory-fitted with FM-200 discharge valve 40A and Plug	MFC-75
115.4 L cylinder factory-fitted with FM-200 discharge valve 50A and Plug	MFC-100
175 L cylinder factory-fitted with FM-200 discharge valve 50A and Plug	MFC-150
63 L cylinder factory-fitted with FM-200 discharge and Nitrogen inlet valves (for use with Nitrogen Cylinder filled to 60 bar, N68-60)	MFC-P50
89 L cylinder factory-fitted with FM-200 discharge and Nitrogen inlet valves (for use with Nitrogen Cylinder filled to 70 bar, N68-70)	MFC-P75
115.4 L cylinder factory-fitted with FM-200 discharge and Nitrogen inlet valves (for use with Nitrogen Cylinder filled to 80 bar, N68-80)	MFC-P100
175 L cylinder factory-fitted with FM-200 discharge and Nitrogen inlet valves (for use with Nitrogen Cylinder filled to 80 bar, N68-80)	MFC-P150
Associated Components	
FM-200 Discharge Valve	
40-mm valve (for use with MFC-50//75/P50/P75 FM-200 Containers)	CVL-R40
50-mm valve (for use with MFC-100/150/P100/P150 FM-200 Containers)	CVL-R50
Interlock tube union	MTU-061
Interlock port protection plug	MTN-060
Nitrogen Inlet Valve (only installed with FM-200 PFS)	CVH-F20
FM-200 EFS CYLINDER LABEL (for use with any model of FM-200 EFS Cylinders)	MFE-L1
FM-200 PFS CYLINDER LABEL (for use with any model of FM-200 PFS Cylinders)	MFP-L1
N₂ CYLINDER LABEL (only used with FM-200 PFS) (for use with any model of N ₂ Cylinders)	MNP-L1
FM-200 NEEDLE CYLINDER (for use with any model of FM-200 Cylinders)	MNC-06
NITROGEN CONTAINER (only installed with FM-200 PFS)	
68 L cylinder factory-fitted with Nitrogen valve, filled to 60 bar (for use with 63 L FM-200 Container, MFC-P50)	N68-60
68 L cylinder factory-fitted with Nitrogen valve, filled to 70 bar (for use with 89 L FM-200 Container, MFC-P75)	N68-70
68 L cylinder factory-fitted with Nitrogen valve, filled to 80 bar (for use with 115.4 L (MFC-P100) and 175 L (MFC-P150) FM-200 Containers)	N68-80

Associated Components	
Nitrogen Valve	CVH-N20
NITROGEN NEEDLE CYLINDER (only installed with FM-200 PFS) (for use with any model of Nitrogen Cylinders)	MNN-06
FLEXIBLE HOSE (20A) (only installed with FM-200 PFS)	
600 mm (for use with 115.4 L and 175 L FM-200 Container and 68 L @ 80 bar Nitrogen Container, MFC-P100/P150 + N68-80 combination)	MFH-206
700 mm (for use with 89 L FM-200 Container and 68 L @ 70 bar Nitrogen Container, MFC-P75 + N68-70 combination)	MFH-207
900 mm (for use with 63 L FM-200 Container and 68 L @ 60 bar Nitrogen Container, MFC-P50 + N68-60 combination)	MFH-209
FLEXIBLE HOSE (50A)	MFH-50
UNION ELBOW	
125 mm	MUE-501
225 mm	MUE-502
Associated components	
Packing	MFP-50
ADAPTER (for use with 63L (MFC-P50) and 89 L (MFC-P75) FM-200 Cylinders; <i>not needed when 115.4 L (MFC-P100) or 175 L (MFC-P150) FM-200 Cylinders are used</i>)	MVA-40
CHECK VALVE	MCV-50
Associated components	
Packing	MFP-50
MANIFOLD WELDING SOCKET	MWS-50
NITROGEN ACTUATION TUBE (only installed with FM-200 PFS)	
500 mm (for use with 115.4 L FM-200 Container and 68 L @ 80 bar Nitrogen Container, MFC-P100/ + N68-80 combination)	MTN-500
530 mm (for use with 89 L FM-200 Container and 68 L @ 70 bar Nitrogen Container, MFC-P75 + N68-70 combination)	MTN-530
600 mm (for use with 63 L FM-200 Container and 68 L @ 60 bar Nitrogen Container, MFC-P50 + N68-60 combination)	MTN-600
FM-200 INTERCONNECT ACTUATION TUBE (only installed with FM-200 PFS)	MFT-320
FM-200 ACTUATION TUBE	MCT-001
SELECTOR VALVE ACTUATION TUBE	MCT-002
PRESSURE SWITCH ACTUATION TUBE	MCT-003
SELECTOR VALVE	
32-mm inlet/outlet	MSV-32
40-mm inlet/outlet	MSV-40
50-mm inlet/outlet	MSV-50
65-mm inlet/outlet	MSV-65
80-mm inlet/outlet	MSV-80

100-mm inlet/outlet			MSV-100					
125-mm inlet/outlet			MSV-125					
150-mm inlet/outlet			MSV-150					
ACTUATION BOX (Assembly)			MAB-C1					
Associated Components								
Solenoid Cutter			MSC-01					
Pilot Cylinder Assembly			MAC-01					
Pressure Switch			MPS-01					
PRESSURE SWITCH (Barksdale)			PIX-B30					
MANUAL STATION (Potter)			RMS-1T					
DISCHARGE NOZZLES (360° type : MFN-00-00(0), 180° type : MFN-R00-00(0))								
No.	Orifice Diameter (mm)	Area(mm ²)	Size and model number					
			15A	20A	25A	32A	40A	50A
1	8.2	52.81	MFN-15-82					
2	8.4	55.42	MFN-15-84					
3	8.6	58.09	MFN-15-86					
4	8.8	60.82	MFN-15-88					
5	9	63.62	MFN-15-90					
6	9.2	66.48	MFN-15-92					
7	9.4	69.4	MFN-15-94					
8	9.6	72.38	MFN-15-96					
9	9.8	75.43	MFN-15-98					
10	10	78.54	MFN-15-100					
11	10.2	81.71	MFN-15-102					
12	10.4	84.95	MFN-15-104					
13	10.6	88.25	MFN-15-106					
14	10.8	91.61	MFN-15-108	MFN-20-108				
15	11	95.03	MFN-15-110	MFN-20-110				
16	11.2	98.52	MFN-15-112	MFN-20-112				
17	11.4	102.07	MFN-15-114	MFN-20-114				
18	11.6	105.68	MFN-15-116	MFN-20-116				
19	11.8	109.36	MFN-15-118	MFN-20-118				
20	12	113.1	MFN-15-120	MFN-20-120				
21	12.2	116.9	MFN-15-122	MFN-20-122				
22	12.4	120.76	MFN-15-124	MFN-20-124				
23	12.6	124.69	MFN-15-126	MFN-20-126				
24	12.8	128.68	MFN-15-128	MFN-20-128				
25	13	132.73	MFN-15-130	MFN-20-130				
26	13.2	136.85	MFN-15-132	MFN-20-132				
27	13.4	141.03	MFN-15-134	MFN-20-134				
28	13.6	145.27		MFN-20-136	MFN-25-136			
29	13.8	149.57		MFN-20-138	MFN-25-138			
30	14	153.94		MFN-20-140	MFN-25-140			
31	14.2	158.37		MFN-20-142	MFN-25-142			

32	14.4	162.86		MFN-20-144	MFN-25-144			
33	14.6	167.42		MFN-20-146	MFN-25-146			
34	14.8	172.03		MFN-20-148	MFN-25-148			
35	15	176.71		MFN-20-150	MFN-25-150			
36	15.2	181.46		MFN-20-152	MFN-25-152			
37	15.4	186.27		MFN-20-154	MFN-25-154			
38	15.6	191.13		MFN-20-156	MFN-25-156			
39	15.8	196.07		MFN-20-158	MFN-25-158			
40	16	201.06		MFN-20-160	MFN-25-160			
41	16.2	206.12		MFN-20-162	MFN-25-162			
42	16.4	211.24		MFN-20-164	MFN-25-164			
43	16.6	216.42		MFN-20-166	MFN-25-166			
44	16.8	221.67		MFN-20-168	MFN-25-168			
45	17	226.98		MFN-20-170	MFN-25-170			
46	17.2	232.35		MFN-20-172	MFN-25-172			
47	17.4	237.79		MFN-20-174	MFN-25-174			
48	17.6	243.28		MFN-20-176	MFN-25-176			
49	17.8	248.85		MFN-20-178	MFN-25-178			
50	18	254.47			MFN-25-180			
51	18.2	260.16			MFN-25-182			
52	18.4	265.9			MFN-25-184			
53	18.6	271.72			MFN-25-186			
54	18.8	277.59			MFN-25-188			
55	19	283.53			MFN-25-190			
56	19.2	289.53			MFN-25-192			
57	19.4	295.59			MFN-25-194			
58	19.6	301.72			MFN-25-196			
59	19.8	307.91			MFN-25-198			
60	20	314.16			MFN-25-200			
61	20.2	320.47			MFN-25-202			
62	20.4	326.85			MFN-25-204			
63	20.6	333.29			MFN-25-206			
64	20.8	339.79			MFN-25-208			
65	21	346.36			MFN-25-210			
66	21.2	352.99			MFN-25-212			
67	21.4	359.68			MFN-25-214			
68	21.6	366.44			MFN-25-216			
69	21.8	373.25			MFN-25-218			
70	22	380.13			MFN-25-220			
71	22.2	387.08			MFN-25-222			
72	22.4	394.08			MFN-25-224			
73	22.6	401.15			MFN-25-226			
74	18	254.47				MFN-32-180		
75	18.5	268.8				MFN-32-185		
76	19	283.53				MFN-32-190		
77	19.5	298.65				MFN-32-195		
78	20	314.16				MFN-32-200		
79	20.5	330.06				MFN-32-205		

80	21	346.36				MFN-32-210	MFN-40-210	
81	21.5	363.05				MFN-32-215	MFN-40-215	
82	22	380.13				MFN-32-220	MFN-40-220	
83	22.5	397.61				MFN-32-225	MFN-40-225	
84	23	415.48				MFN-32-230	MFN-40-230	
85	23.5	433.74				MFN-32-235	MFN-40-235	
86	24	452.39				MFN-32-240	MFN-40-240	
87	24.5	471.44				MFN-32-245	MFN-40-245	
88	25	490.87				MFN-32-250	MFN-40-250	
89	25.5	510.71				MFN-32-255	MFN-40-255	
90	26	530.93				MFN-32-260	MFN-40-260	
91	26.5	551.55				MFN-32-265	MFN-40-265	MFN-50-265
92	27	572.56				MFN-32-270	MFN-40-270	MFN-50-270
93	27.5	593.96				MFN-32-275	MFN-40-275	MFN-50-275
94	28	615.75				MFN-32-280	MFN-40-280	MFN-50-280
95	28.5	637.94				MFN-32-285	MFN-40-285	MFN-50-285
96	29	660.52				MFN-32-290	MFN-40-290	MFN-50-290
97	29.5	683.49				MFN-32-295	MFN-40-295	MFN-50-295
98	30	706.86					MFN-40-300	MFN-50-300
99	30.5	730.62					MFN-40-305	MFN-50-305
100	31	754.77					MFN-40-310	MFN-50-310
101	31.5	779.31					MFN-40-315	MFN-50-315
102	32	804.25					MFN-40-320	MFN-50-320
103	32.5	829.58					MFN-40-325	MFN-50-325
104	33.0	855.3					MFN-40-330	MFN-50-330
105	33.5	881.41					MFN-40-335	MFN-50-335
106	34.0	907.92					MFN-40-340	MFN-50-340
107	34.5	934.82						MFN-50-345
108	35.0	962.11						MFN-50-350
109	35.5	989.8						MFN-50-355
110	36	1017.9						MFN-50-360
111	36.5	1046.4						MFN-50-365
112	37	1075.2						MFN-50-370
113	37.5	1104.5						MFN-50-375
114	38	1134.1						MFN-50-380
115	38.5	1164.2						MFN-50-385
116	39	1194.6						MFN-50-390
117	39.5	1225.4						MFN-50-395
118	40	1256.6						MFN-50-400
119	40.5	1288.3						MFN-50-405
120	41	1320.3						MFN-50-410
121	41.5	1352.7						MFN-50-415
122	42	1385.4						MFN-50-420
123	42.5	1418.6						MFN-50-425
124	43	1452.2						MFN-50-430
125	43.5	1486.2						MFN-50-435
126	44	1520.5						MFN-50-440



PARTS AND SERVICES

For warranty consideration, parts, or other service information, contact your authorized distributor. If you need further assistance, please contact

MASTECO INDUSTRY CO., LTD.

715-12 Gojang-dong, Namdong-gu

405-821, Incheon, Republic of Korea

Tel.: 82-32-811-1301

Email: overseas@masteco.co.kr

Office hours: 8:00 AM – 5:00 PM

Time Zone: GMT + 9

For prompt, efficient service, kindly prepare the following information:

- Model number of the specific component
- Component description obtained from the Parts List
- Year of manufacture when applicable
- Original purchase slip or equivalent evidence of purchase date

LIMITED WARRANTY POLICY

MASTECO INDUSTRY CO., LTD. 715-12 Gojan-dong, Namdong-gu, 405-821, Incheon, Republic of Korea, hereby provides a limited warranty against defects in material and workmanship on all FM-200 EFS & PFS components manufactured by MASTECO INDUSTRY CO., LTD. These components include 1 year warranty which is limited to, at Manufacturer's option, replacement or repair of defective components or refunding the purchase price for such components paid by the Buyer. Within the warranty period, the Buyer has the right to enforce such warranties and obligate the Manufacturer.

The warranty period shall begin on the date of purchase as indicated in the original receipt of purchase or original sales receipt issued by the distributor. This warranty shall not apply if:

- A. any component has been altered or modified without the knowledge of warrantor's authorized representative;
- B. the product has been subjected to neglect, misuse, abuse or damage or has been installed or operated other than in accordance with the manufacturer's design, installation, operation, and maintenance (DIOM) manual (M/N: MM-FM200-01).


To make a claim against this warranty, contact the MASTECO INDUSTRY CO., LTD. Sales Department at 82-2-785-1301 or mail to MASTECO INDSUTRY CO., LTD., Sales Department, 1001, Byuksan Digital Valley, 60-73, Kasan-dong, Kumchun-gu, Seoul, 183-801, Republic of Korea.

The company shall, notify the customer to either send the product, transportation prepaid, to the company at its office in Incheon, Republic of Korea or to a duly authorized service center. The company shall perform all obligations imposed on it by the terms of this warranty within 60 days of receipt of the defective product.



MASTECO INDUSTRY CO., LTD. EXCLUDES LIABILITY UNDER THIS WARRANTY FOR DIRECT, INDIRECT, INCIDENTAL AND CONSEQUENTIAL DAMAGES INCURRED IN THE USE OR LOSS OF USE OF THE PRODUCT WARRANTED HEREUNDER.

CERTIFICATE OF COMPLIANCE

Piston Flow System UL

CERTIFICATE OF COMPLIANCE		CERTIFICATE OF COMPLIANCE																																																													
Certificate Number	20160415-EX15719	Certificate Number	20160415-EX15719																																																												
Report Reference	EX15719-20140430	Report Reference	EX15719-20140430																																																												
Issue Date	2016-APRIL-15	Issue Date	2016-APRIL-15																																																												
Issued to:	MASTECO INDUSTRY CO LTD 715-12 146 BI 13LI Gojan-Dong Namdong-Gu Incheon 405-821 KOREA	This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements.																																																													
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Piston Flow System ULC

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Easy Flow System UL

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