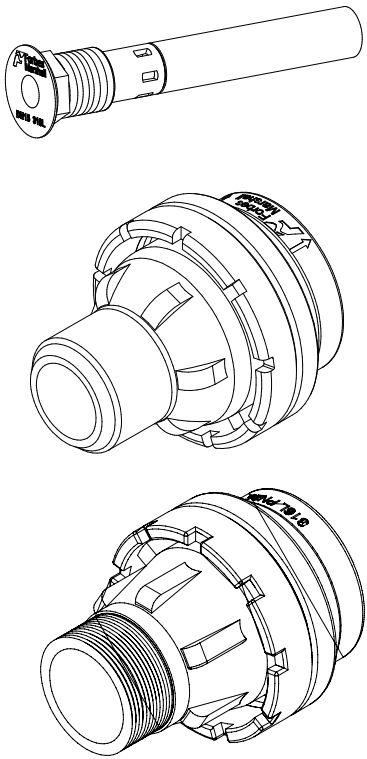
Installation and Maintenance Manual

Steam Injectors

FMINJ



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PLEASE NOTE - Throughout this manual this cautionary symbol is used to describe a potential damage or injury that might occur if the safety considerations are overlooked. This symbol denotes CAUTION, WARNING or DANGER.

1. Preface:

This manual is intended for anyone using, commissioning, servicing, or disposing the below mentioned products safely and efficiently.
Forbes Marshall Steam Injectors (FMINJ)
Size: 1/2" , 1" & 1-1/2"

2. Safety information:

It is the responsibility of the user to ensure that the product is installed and operated safely. Safe operation of these products can only be guaranteed if they are properly installed, commissioned, used and maintained by qualified personnel (see Section 1.11) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

2.1 Intended use

i) Check that the product is suitable for use with the intended fluid.

ii) Check the necessary parameters like material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous over pressure or over temperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.

iii) Ensure the product is properly installed ensuring the right direction of fluid flow.

iv) Remove protection covers from all connections before installation.

2.2 Access

Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required.

2.3 Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

2.4 Hazardous liquids or gases in the pipeline

Consider what is in the pipeline or what may have been in the pipeline at some Previous time.
Consider: flammable materials, substances hazardous to health, extremes of temperature.

2.5 Hazardous environment around the product

Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, Extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

2.6 The system

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk?

Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

2.7 Pressure systems

Ensure that any pressure is isolated and safely vented to atmospheric pressure. Consider double isolation (double block and bleed) and the locking or labelling of closed valves. Do not assume that the system has depressurised even when the pressure gauge indicates zero.

2.8 Temperature

Allow time for temperature to normalise after isolation to avoid danger of burns.

2.9 Tools and consumables

Before starting work ensure that you have suitable tools and / or consumables available. Use only genuine replacement parts.

2.10 Protective clothing

Consider whether you and/or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high/low temperature, radiation, noise, falling objects, and dangers to eyes and face.

2.11 Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions.

Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.

Post 'warning notices' if necessary.

2.12 Handling

Manual handling of large and/or heavy products may present a risk of injury. Lifting,pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

2.13 Residual hazards

In normal use the external surface of the product may be very hot.

Many products are not self-draining. Take due care when dismantling or removing the product from an installation.

2.14 Freezing

Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

2.15 Safety information - Product specific

Steam injectors operate at temperatures which could cause severe scalding, and produce strong currents of very hot water. Do not touch or lean over open tanks which are being heated, even if the water still appears to be cold. Ensure closed tanks are adequately vented and that the vent is unobstructed. Steam supply pipework must be firmly anchored to prevent vibration and stress in the tank wall. Tanks must be adequately constructed and braced/stayed as necessary to avoid vibration. Consult your local FM engineer if in any doubt.

2.16 Disposal

This product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

3. Brief Product Information :

Description:
Forbes Marshall Steam Injector is used to raise the temperature of water using steam. High velocity steam flows through the nozzles which creates inflow of surrounding water and during this process the steam & water mixes uniformly giving a uniform temperature in the tank.

Sizes and Pipe connections:
½", 1", & 1½".

Size	End Connections
½"	BSPT/NPT
1' & 1½"	BSPT/NPT/Socket Weld Ends

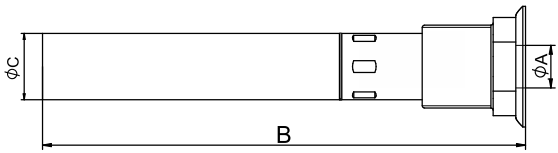
FM Steam Injectors offer:
- SS316L construction.
- Very compact and reliable design
- Easy to use for applications like boiler feed tank, pressurised deaerators.
- Ensures efficient heating process.

Pressure/temperature limits

Body design rating	PN25
Minimum operating pressure	7.2 psi g
Maximum saturated steam condition	246.5 psi g @ 404.6°F
Maximum heated liquid temperature	194°F
(tank/vessel vented to atmosphere)	

Material: Austenitic stainless steel ASTM A351 CF3M.

Dimensions/weights (approximate) in mm			
Type	A	B	C
FMINJ15	½"	7.71"	1.1"
FMINJ25M	1"	3.3"	2.79"
FMINJ40M	1½"	4.4"	3.46"



4. Installation Guidelines:

FMINJ1”M and FMINJ1½” are supplied in male thread (BSPT or NPT) or butt-weld form. They may be fitted to a tank wall connection or to pipework in the tank. It may be necessary to fit a reinforcing plate to the tank wall.

The FMINJ ½” has a 1" male thread for direct mounting to a tank wall and a ½" female thread for the steam supply pipework.

Do not use a wrench on the round body of an injector - ribs on the injector body allow a spanner to be used for fitting.

For higher capacities, two or more injectors may be fitted in parallel.

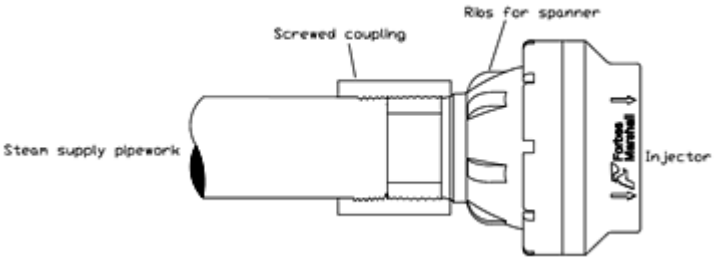


Fig. 2 FMINJ1” /FM INJ1½”M- Typical screwed installation direct to pipework

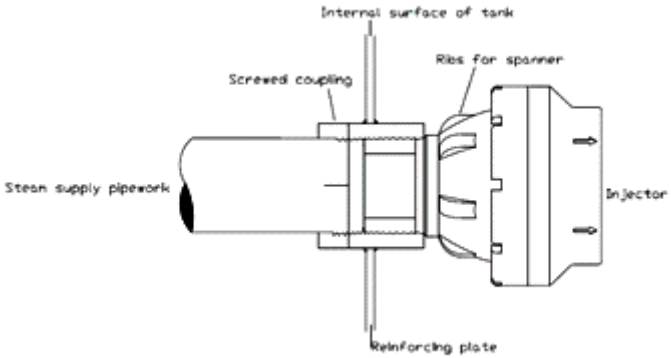


Fig. 3 FMINJ1” / FMINJ1½” - Screwed coupling through tank wall

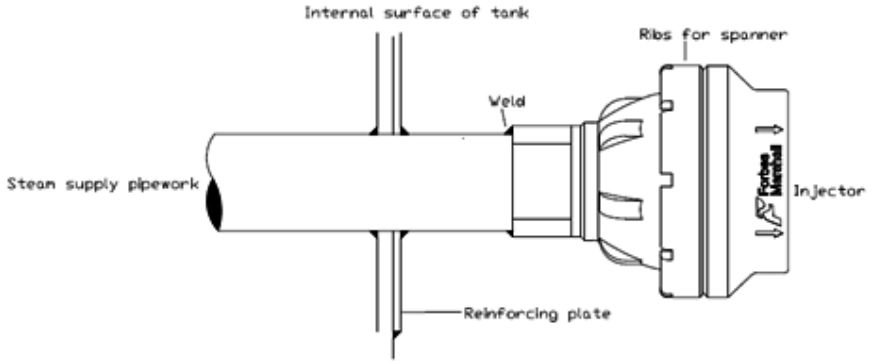


Fig. 2 FMINJ25 /FM INJ40M- Typical screwed installation direct to pipework

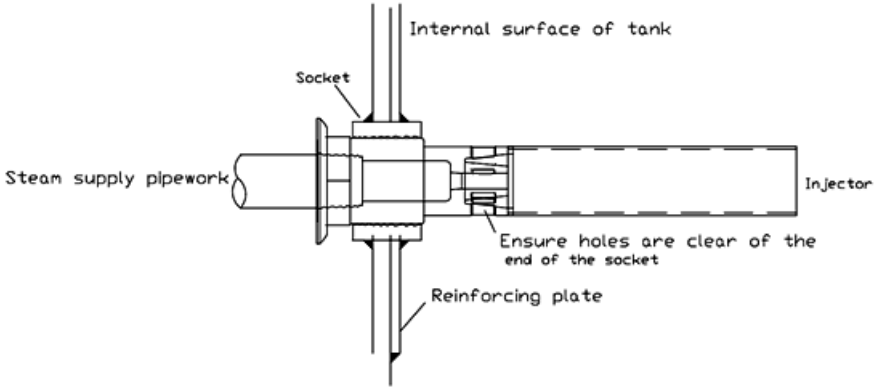


Fig. 5 FMINJ25 injector - Typical installation through tank wall

4.1 Pipeline sizing

Use the same size pipe as the injector:-
½" mm pipe for FMINJ½", 1" pipe for FMINJ2M and 1½" pipe for FMINJ1½"Pipe sizes for multiple injector installations are as follows:-

No. of injectors	Type	Minimum pipe size
2	FMINJ15	0.787"
2	FMINJ25	2.55"
	FMINJ40	3.14"

4.2 Recommended layout

Position the injector:
- horizontally,
- at low level,
- on the vertical centre line of the tank, (single injectors), a minimum of 5.9 inch from the side of the tank.
- At one end of the tank.

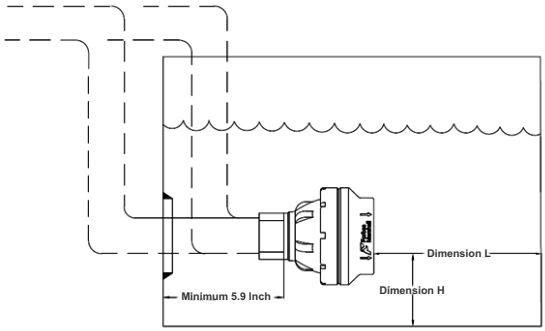
The injector may be installed on a coupling through the tank wall, or on a short pipeline as close to the end of the tank as possible.
Pipework may be run inside or outside the tank. We recommend the use of a suitable thread locking compound on all threaded connections.
Discharge from the injector must be kept clear of any obstructions in the tank, e.g. pipework, stays, etc.
The distance between the injector and the end of the tank (L) must be as great as possible for quietest operation.

The following minimum dimensions apply:-

Steam pressure at injector inlet (psi g)	FMINJ½" minimum length (L)	FMINJ1" /FM INJ1½"
7.25 - 101.52	9.84 Inch	19.86 Inch
102.97 - 145	11.81 Inch	29.52 Inch
146.48 - 203.05	13.77 Inch	39.37 Inch
204.5 - 246.56	15.74 Inch	49.21 Inch

A minimum depth of water must be allowed below the injector (H):-

Injector type	Minimum dimension
FMINJ½"	3.93 Inch
FMINJ1"	5.9 Inch
FMINJ1½"	7.87 Inch



Multiple injectors Position the injectors equally across the width (W) of the tank to ensure adequate mixing and maximum circulation. Leave at least 5.9 Inch between the injectors and the tank side, and at least 11.81 Inch between injectors.

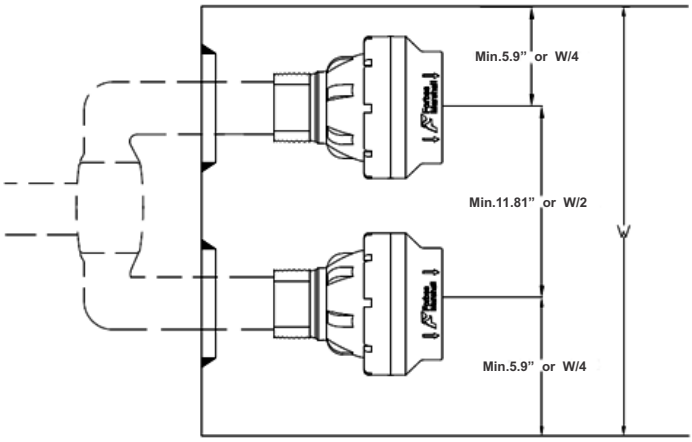


Fig. Two Injector layout

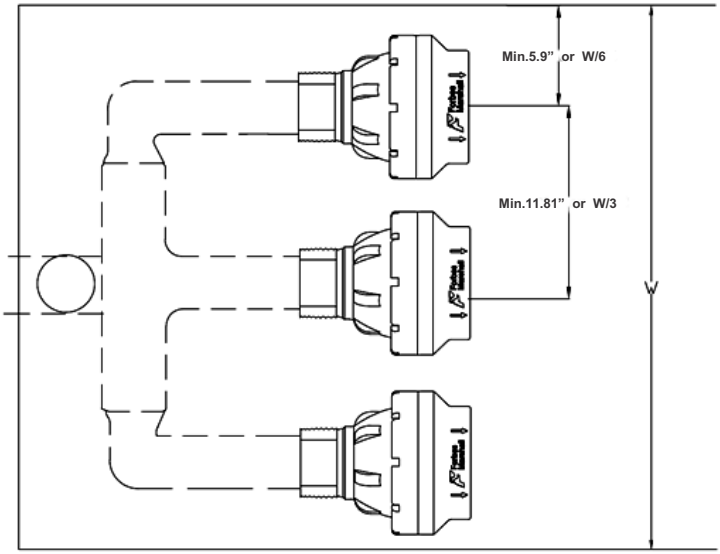
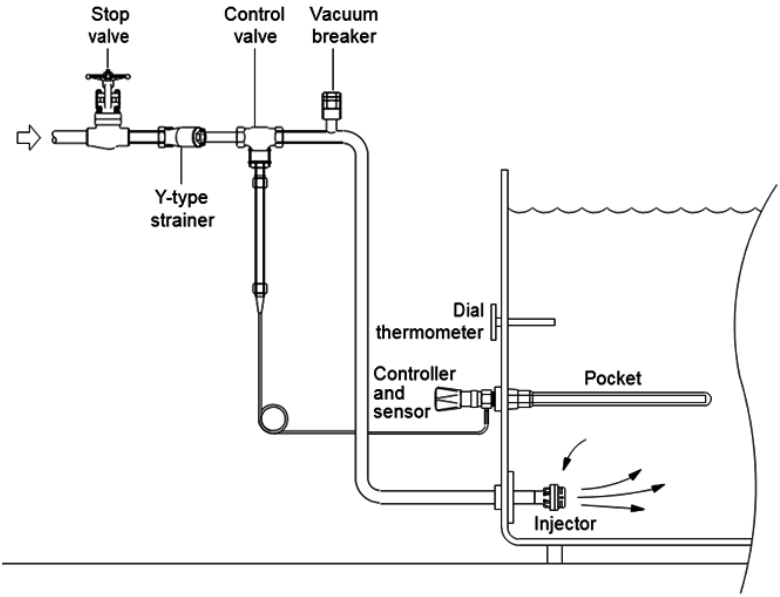


Fig. Three Injector layout

4.3 Systems

A typical system is shown in Figure 9. All system parts should be fitted in a horizontal pipeline situated above the top of the tank. We recommend the fitting of a stop valve and a Y-type strainer upstream of the control valve. Install the strainer on its

side to prevent a water pocket forming. Install the sensor and sensor pocket approximately one third of the way up the tank, ideally above, or above and to one side of, the injector(s). For boiler feedtank applications, keep the sensor well away from the cold make-up, condensate return, and flash steam inlets.
If used, install the dial thermometer near the sensor.



5. Maintenance

No specific maintenance is required. Any temperature controller should be calibrated periodically. We recommend an annual inspection of the injector and the steam supply pipework. Check that the injector discharge holes are not obstructed and that any screw threads are tight. Check that the tank vent is clear. Clean any strainer in the injector system.

6. Fault finding

If correctly sized, controlled, and installed in a suitable tank, the steam injector(s) will operate quietly with minimum noise and vibration. Noisy operation on installation could be caused by inadequately braced pipework or loose connections.
Excessive noise and / or vibration in service is extremely unusual, but could be caused by an injector becoming loose or detached, or by one or more of the injector outlet nozzles becoming blocked.
Heavy vibration may occur if the tank temperature is allowed to exceed 194°F, as the steam will not condense fully.
If severe vibration is experienced, do not continue to use the injector(s), or the tank may be damaged. Shut off the steam supply and investigate the fault immediately

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