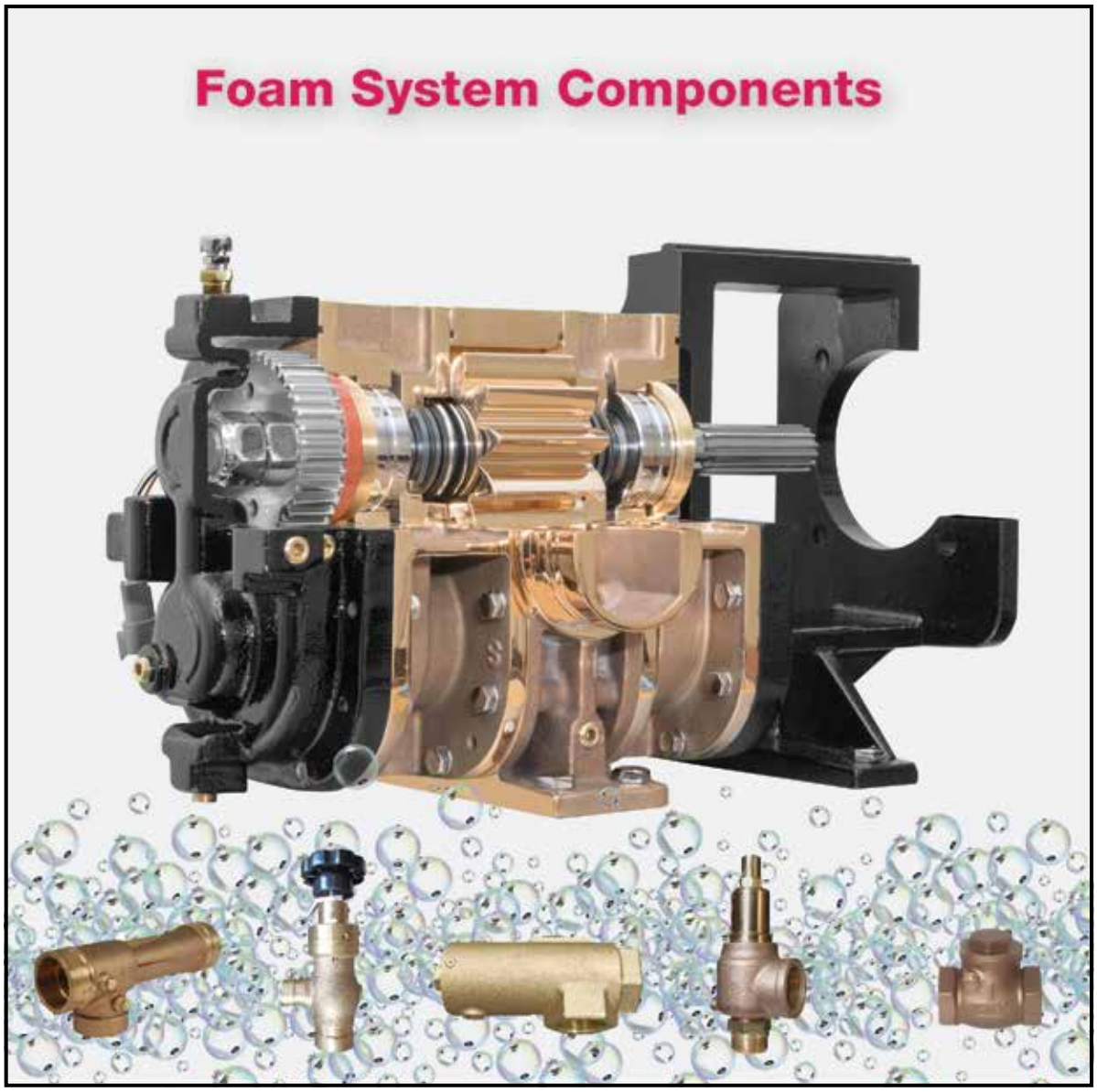
TRIDENT
Emergency Products, LLC

Balanced Pressure
Foam Proportioning
Technical Guide



World Class Fire Industry Products

Contents

Balanced Pressure Foam Proportioning

Balanced pressure foam proportioning is a tried and true method of accurately mixing foam concentrate into a water stream at various flows, pressures and injection rates. The proportioning components are easily installed into most any plumbing on fire apparatus. This Technical Guide outlines basic balanced foam pressure proportioning, necessary components and components that Trident can provide. A balanced pressure foam proportioning system works in conjunction with the installed fire pump, where any or all water discharges can be piped to allow foam solution discharge with separate control. The apparatus must be equipped with an on-board foam concentrate tank and be able to take foam concentrate into the system from external sources.

Each foam/water discharge will require a ratio controller (proportioner) to inject foam concentrate into the water stream. The foam concentrate is delivered to the ratio controller through a metering valve that is adjustable to required injections rates; typically, 1%, 3% or 6%. Ratio controllers currently are available in four (4) different sizes/flow ranges, each with a matching metering valve. A foam pump provides pressurized foam concentrate from either the on-board foam tank or from external sources; drums or totes. Foam pumps are available in several discharge capacities to best match the maximum potential flow of the water pump, from either an on-board water tank, draft conditions, or pressurized water source (hydrant or relay pumper). A balancing valve is utilized to continually 'balance' the foam pressure to match the water pressure, and return extra foam pump output back to tank.

A transmission mounted PTO is the most cost effective approach to driving the foam pump. Careful consideration is required when selecting PTO ratio, so as not to exceed maximum foam pump operating speed of 1800 RPM. Foam pumps can be mounted in most any position to provide close access to the driveshaft from the PTO. See the foam pump technical manuals for available pump drive shaft positions and flow orientation. The technical manuals provide foam pump horsepower requirements for selecting proper size PTO and driveshaft. Foam pumps can also be hydraulic driven, but this type of drive system requires many more components and is more costly.

Trident Supporting Data Sheets

- Ratio Controllers #99.011.06
- Metering Valves #99.011.07
- Balancing Valve #99.011.01
- Check Valves #99.011.4
- Relief Valves #99.011.03
- GP30/GP60 Foam Pump Technical Manual #99.013.1
- GP120/GP160/GP200 Foam Pump Technical Manual #99.013.2
- Foam Pump Ordering Guide #99.011.08

Trident Emergency Products, LLC has a responsibility to provide high quality components to our customers. Installation and operation of firefighting equipment and products should only be done by qualified companies and personnel.

This Technical Guide provides an outline of balanced pressure proportioning, minimum required components, component selection and piping layouts in an effort to provide sufficient installation information to the installer. Final system designs are the determination of the apparatus builder and end user.

Any questions about this Technical Guide or Trident products, please contact Trident Emergency Products.

Component Description Listing - See Piping Schematic on Pages 4/5 to Identify Items

1. **Tank-to-Pump Valve**: Main foam tank shut-off valve. Valve and foam pump suction piping must be the same size as the foam pump ports, at a minimum. Valve **MUST** be closed during flushing operation. Control of this valve must be at the pump operator's position.
2. **Foam Tank Drain Valve**: Typically, 2" [50.8 mm] in size with a plug, in case of accidental opening. Piping and control of this valve can be routed to the edge of the apparatus for ease of access.
3. **Auxiliary Foam Concentrate Intake/Flush-In Valve**: This valve allows water to be pumped into the foam piping for flushing operation and as an auxiliary foam concentrate intake, if the on-board tank is depleted. This valve can be used to refill the on-board storage tank in conjunction with the foam pump and the Tank Fill Valve. Valve size is normally 1-1/2" [38.1 mm] or 2-1/2" [63.5 mm] depending on foam pump size and required system flow. Control of this valve must be at the pump operator's position.
4. ***Strainer**: A strainer is required upstream of the foam pump to protect large objects from entering and damaging the pump. Strainer mesh should be no smaller than 1/4" [6.35 mm] to prevent cavitation. A standard Y-pattern type strainer can be used with connection sizes matching the foam pump ports. A shutoff valve can be added to the strainer flushing port.
5. ***Compound Gauge**: A compound gauge with a flushing drain can be installed on the suction side of the foam pump to monitor suction conditions. High vacuum readings can indicate suction piping restrictions and/or foam pump cavitation.
   This gauge is not a requirement for system operation.
6. ***Positive Displacement Foam Pump**: The Positive Displacement pump provides pressurized foam concentrate for each foam/water discharge. The pump is sized to match the total flow capacity of all the foam/water discharges or the total fire pump capacity. The foam pump is typically PTO driven from apparatus transmission. See **Page #8** for Foam Pump selection guidelines.
7. ***Relief Valve**: A relief valve is required to protect the foam pump and discharge piping from over pressurization. Relief valve discharge must **NOT** include any type of shut-off valve. See piping Schematics on Pages #4 and #5 for details. Relief valve set pressure should be 25 PSI [2 BAR] over maximum expected fire pump operating pressure from a pressurized source.
8. ***Pressure Gauge**: A pressure gauge with a flushing drain can be installed on the discharge side of the foam pump to monitor pump pressure when discharging through the Foam Concentrate Discharge Valve. *This gauge is not a requirement for system operation.*
9. **Foam Concentrate Discharge/Flush-Out Valve**: This valve allows foam concentrate to be pumped directly from the tank for draining or to foam makers not installed on the apparatus. This valve can also be opened for flushing operation. Valve size is normally 1-1/2" [38.1 mm] or 2-1/2" [63.5 mm] depending on foam pump size. Control of this valve must be at the pump operator's position.
10. **Tank Fill Valve**: This valve can be opened to re-fill the on-board foam tank in conjunction with the foam pump and Auxiliary Foam Concentrate Intake/Flush-In valve. Valve size is normally 1" [25.4 mm] or 2" [50.8 mm] depending on foam pump size. Valve **MUST** be closed during flushing operation. Control of this valve must be at the pump operator's position.
11. **Balancing Valve Shut-Off**: A 2" [50.8 mm] shutoff valve must be installed ahead of the balancing valve. This valve can be closed in the event the balancing valve fails and balanced proportioning can then be controlled by the Manual Balancing Gate Valve. Control of this valve must be at the pump operator's position.
12. ***Balancing Valve**: The 2" [50.8 mm] balancing valve is required to balance the foam pressure to the water pressure and return extra foam pump output back to tank. A port is available for a drain valve on the water side.
13. **Manual Balancing Gate Valve**: A 2" [50.8 mm] **GATE** valve is installed in the discharge piping ahead of the balancing valve. In the event the balancing valve fails, the gate valve can control foam concentrate returning to the tank to maintain balanced pressure. A non-rising stem gate valve is preferred choice, as ball valves are difficult to throttle the flow and can drift open or close. Control of this valve must be at the pump operator's position.
14. **Foam Concentrate Return to Tank Valve**: A 2" [50.8 mm] shutoff valve is installed to return extra foam concentrate not used by the ratio controllers. Valve **MUST** be closed during flushing operation. Control of this valve must be at the pump operator's position.
15. ***Duplex Gauge**: A duplex gauge with flushing drains is required to monitor both water and foam pressures and used by the operator to ensure the foam and water pressures are matched. The gauge is connected to the discharge side of the water pump and foam pump. When the two needles (black for water pressure, red for foam pressure) are indicating the same pressure, the proportioning system is balanced.
16. **Foam Concentrate Distribution Manifold**: The manifold supplies foam concentrate to each metering valve ahead of the ratio controller. The manifold is typically 2" [50.8 mm] or 3" [76.2 mm] pipe depending on foam pump size and equipped with a drain valve.
17. ***Check Valve**: A check valve **MUST** be installed ahead of each metering valve to prevent water flowing back into the foam piping and potentially diluting the foam tank. **NOTE**: Swing type check valves are preferable over ball type due to lower flow resistance. Swing check valves must be installed in the horizontal position.
18. ***Foam Concentrate Metering Valve**: The metering valve is installed after the foam concentrate manifold, ahead of the ratio controller. Metering valves are a positive shut-off device allowing for the Tank-to-Pump valve to be left in the open position. This allows for a faster foam system response time once activated. Refer to piping schematic for stand-by valve positions. Control of this valve must be at the pump operator's position.
19. ***Ratio Controller:** A ratio controller is installed in each foam/water discharge ahead of the discharge shutoff valve. See selection chart for available ratio controller sizes and flow ranges.
20. **Component Flushing Drain Valves:** Many of the Balanced Pressure Proportioning components are recommended to have flushing drain valves installed to completely drain the device after system flushing is completed. These valves must be installed in easily accessible location(s).

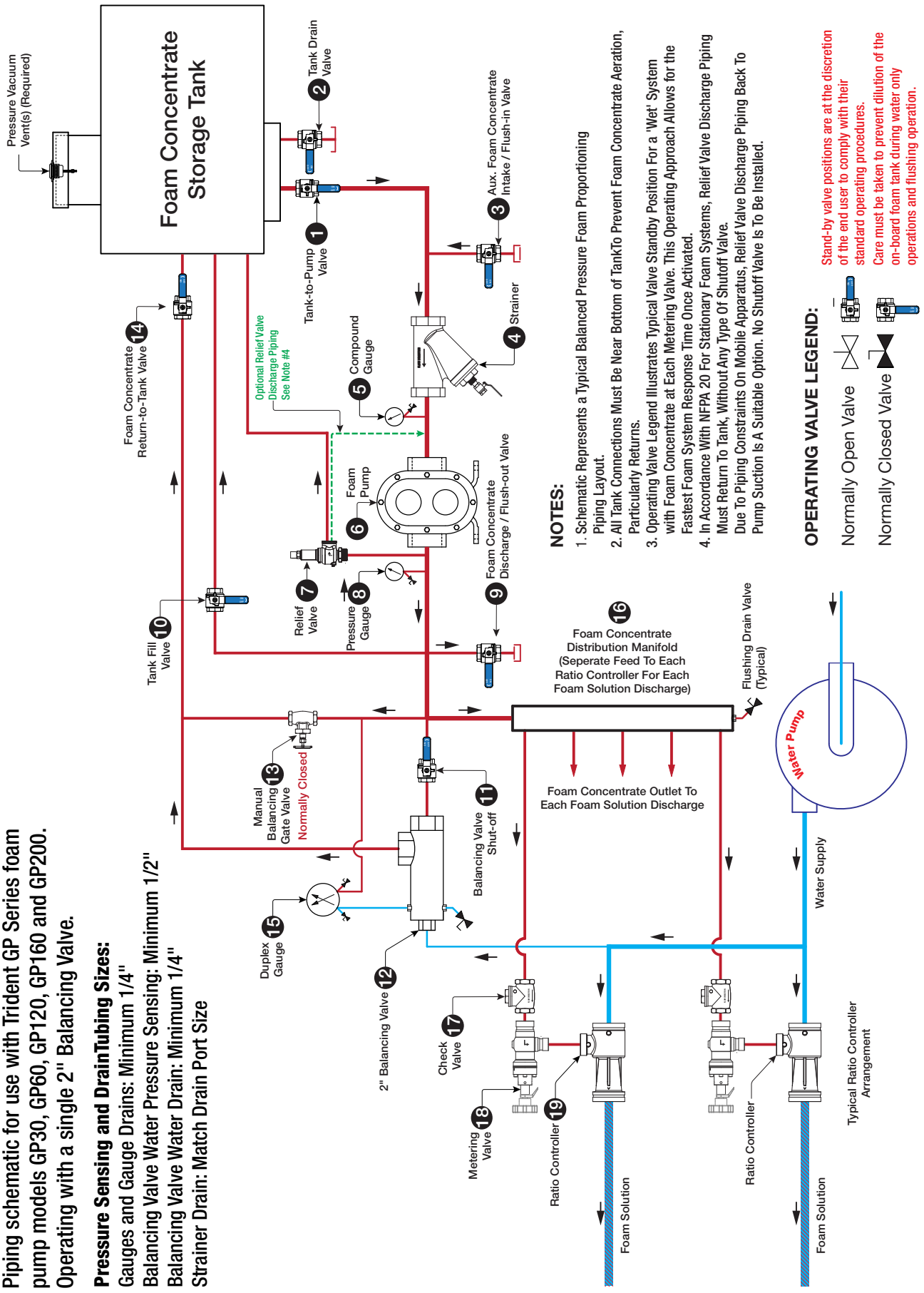
NOTE: Items listed above with * are available from Trident Emergency Products.

Balanced Pressure Foam Proportioning Schematic

P&ID Piping Schematic Illustrates a Typical Mobile Equipment
Balanced Pressure Foam Proportioning Piping Layout and Required Components.
See Component Descriptions on Page 3.

Piping schematic for use with Trident GP Series foam
pump models GP30, GP60, GP120, GP160 and GP200.
Operating with a single 2" Balancing Valve.

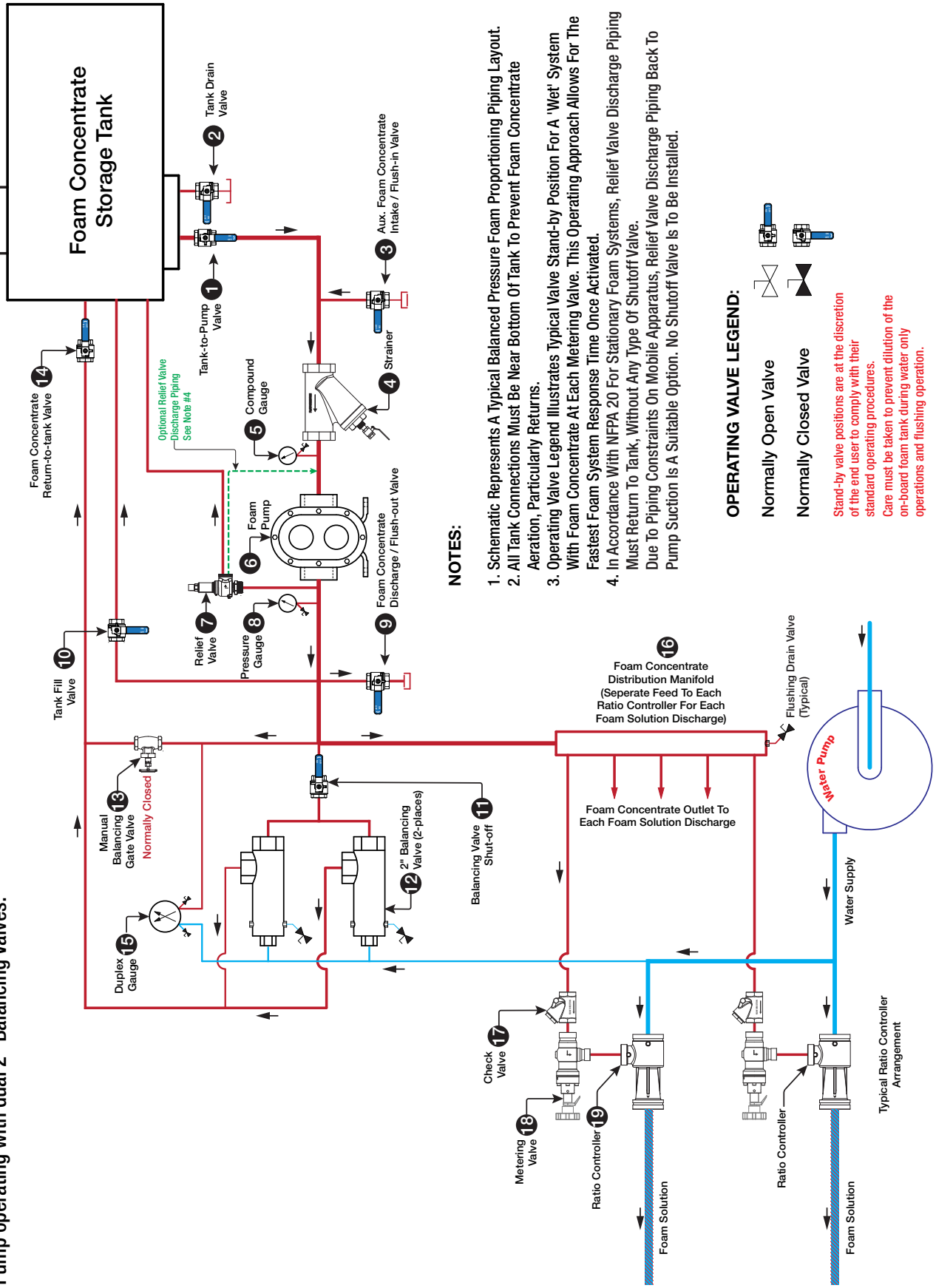
Pressure Sensing and DrainTubing Sizes:
Gauges and Gauge Drains: Minimum 1/4"
Balancing Valve Water Pressure Sensing: Minimum 1/2"
Balancing Valve Water Drain: Minimum 1/4"
Strainer Drain: Match Drain Port Size



Balanced Pressure Foam Proportioning Schematic - GP300 Only

P&ID Piping Schematic Typical Balanced Pressure Foam Proportioning
For Mobile Equipment Apparatus With Dual Balancing Valves
See Component Descriptions on Page 3.
Piping schematic for use with Trident GP300 Series Foam
Pump operating with dual 2" Balancing Valves.

Pressure Sensing and DrainTubing Sizes:
Gauges and Gauge Drains: Minimum 1/4"
Balancing Valve Water Pressure Sensing: Minimum 1/2"
Balancing Valve Water Drain: Minimum 1/4"
Strainer Drain: Match Drain Port Size



NOTES:

1. Schematic Represents A Typical Balanced Pressure Foam Proportioning Piping Layout.
2. All Tank Connections Must Be Near Bottom Of Tank To Prevent Foam Concentrate Aeration, Particularly Returns.
3. Operating Valve Legend Illustrates Typical Valve Stand-by Position For A 'Wet' System With Foam Concentrate At Each Metering Valve. This Operating Approach Allows For The Fastest Foam System Response Time Once Activated.
4. In Accordance With NFPA 20 For Stationary Foam Systems, Relief Valve Discharge Piping Must Return To Tank, Without Any Type Of Shutoff Valve. Due To Piping Constraints On Mobile Apparatus, Relief Valve Discharge Piping Back To Pump Suction Is A Suitable Option. No Shutoff Valve Is To Be Installed.

OPERATING VALVE LEGEND:

Normally Open Valve

Normally Closed Valve

Stand-by valve positions are at the discretion of the end user to comply with their standard operating procedures. Care must be taken to prevent dilution of the on-board foam tank during water only operations and flushing operation.

Component and Piping Recommendations

1. **FOAM CONCENRATE TANK**: Refer to the latest edition of NFPA 1901 for tank recommendations.
   a. Typical foam tank construction requires a gasketed tank lid to prevent excessive air contact with the foam concentrate. As such pressure vacuum vent(s) are required to allow air to move in and out of the tank during foam pump operation. Vacuum vent selection and quantity need to be determined by foam pump capacity.
   b. Chassis flexing can apply stress to foam tank connections. Flexible hose and flexible joints should be used to prevent tank damage. All piping connections to and from the tank should be done as close as possible to the bottom of the tank to prevent entraining air into the concentrate at low liquid levels. Anti-swirl plates are recommended on all suction connections, baffles are recommended on all return connections.
   c. A valved tank drain with plug located in the sump with the Tank-to-Pump connection is recommended.
2. **FOAM PUMP SUCTION and DISCHARGE PIPING**:
   a. All foam concentrate piping and foam solution piping components should be brass or stainless steel for best compatibility with foam liquids.
   b. All suction and discharge piping must be independently supported to prevent placing loads on the foam pump.
   c. Foam concentrate piping between the foam tank and foam pump is critical, as not to create a potential cavitation issue. Piping, Tank-to-Pump valve, and strainer must be, at a minimum, the same size as the pump suction port. Piping runs should be as short as possible and number of 90° elbows should be kept to a minimum. Consider increasing piping by one pipe size for long piping runs, excessive fittings, or high viscosity foam concentrates. All valves must be full port/full flow design. A check valve can be installed in this piping as added insurance against possible back flow of water, but flow values of selected valve must be reviewed, so as not to impeded foam concentrate flow.
3. **FOAM PUMP MOUNTING**:
   a. The foam pump mounting bracket must be of sturdy construction to prevent flexing of pump or attached piping. All suction and discharge piping must be independently supported to prevent placing loads on the foam pump.
   b. Foam pump mounting location must be convenient to the drive mechanism and piping connections.
   c. The foam pump mounting bracket must be of heavy duty steel construction to properly support foam pump weight and prevent flexing of pump or attached piping. Bracket must be securely bolted to a steel structure, such as chassis frame rail. All suction and discharge piping must be independently supported to prevent placing loads on the foam pump.

The following series of procedures are only guidelines for establishing a final apparatus and foam system operating manual by the apparatus manufacturer and end user. The exact order of activation and operational procedures may vary depending fire pump manufacturers recommendations and fire department standard operating procedures. Upon arrival at the scene, and prior to any fire pump or foam system operations, the fire apparatus must be properly positioned and setup in accordance with all safety procedures.

Balanced Pressure Foam Proportioning - Activation and Operation

1. Confirm foam tank is full.
2. Confirm tank-to-pump valve is open. **Item #1 on diagram.**
3. Confirm auxiliary foam concentrate intake/flush-in valve is closed. **Item #3 on diagram.**
4. Confirm foam concentrate discharge/flush-out valve is closed. **Item #9 on diagram.**
5. Confirm balancing valve shut-off valve is open. **Item #11 on diagram.**
6. Confirm manual balancing gate valve is closed. **Item #13 on diagram.**
7. Confirm tank fill valve is closed. **Item #10 on diagram.**
8. Confirm foam concentrate return-to-tank valve is open. **Item #14 on diagram.**
9. Confirm all metering valves are closed. **Item #18 on diagram.**
10. Engage fire pump and open required foam/water discharge valve(s).
11. Engage foam pump drive mechanism. If PTO drive, check with PTO manufacturer for maximum engine engagement speed.
12. Open metering valve(s) to required injection rate for discharge(s) needing foam solution. Do not open metering(s) valve(s) not flowing water. **Item #18 on diagram.**
13. Monitor duplex gauge to confirm balanced pressures between the water and the foam concentrate. **Item #15 on diagram.**
14. Monitor on-board foam concentrate tank level to prevent foam pump from operating in a dry condition. If on-board tank is depleted, consider operating from an external foam supply. **See Page #7 for details.**

Balanced Pressure Foam Proportioning - Manual Operation Without Balancing Valve

1. In the unlikely failure of the balancing valve to automatically control foam concentrate pressure to match the water pressure, the pressure balancing can be controlled manually using the manual balancing valve **Item #13 on diagram.**
2. Close balancing valve shut-off valve **Item #11 on diagram**.
3. Open manual balancing gate valve until foam pressure indicated on the duplex gauge **Item #15 on diagram** matches the water pressure.
4. This operation will have to be monitored closely if foam/water discharges are opened or closed, or water pressure increases or decreases.

Balanced Pressure Foam Proportioning - Shutting Down

1. Disengage foam pump drive mechanism. If PTO drive, check with PTO manufacturer for maximum engine disengagement speed.
2. Close all metering valves. **Item #18 on diagram.**
3. Water only operation may continue as required.

Balanced Pressure Foam Proportioning - Flushing

Exposure of foam concentrates and foam solution to personnel and the environment are of major concern in many areas around the world. Local authorities should be consulted with regards to foam system flushing. Trident supplied components for use in balanced pressure foam proportioning systems are not subject to deterioration or degradation by foam concentrates or foam solution when exposed for long periods of time. However, over long periods of time, foam concentrates can dry and 'cake' inside small gauge lines, potentially leading to false instrument readings.

1. **SPECIAL NOTATION: Confirm Tank-To-Pump Valve, Tank Fill Valve, and Foam Concentrate Return-To-Tank Valve are Closed! Valves #1, #10, and #14. Failure To Close These Valves Will Result In Water Diluting The Foam Concentrate In The Tank**.
2. Open balancing valve shut-off valve and manual balancing gate valve. **Items #11 and #13 on diagram**.
3. Connect a pressurized water source to the auxiliary foam concentrate intake/flush-in valve **Item #3 on diagram**. Water source can be from on-board fire pump or hydrant. Engage and operate the foam pump at a slow speed to circulate flushing water. Keep pressure to a minimum: 50-100 PSI [.02-.05 BAR] **Caution: Do Not Over Pressurize The System While Flushing. This May Cause The Relief Valve To Open And Dilute The Foam Concentrate Tank**.
4. Open foam concentrate discharge/flush-out valve. **Item #9 on diagram.**
5. Open flush-out drains on Strainer **#4**, Compound Gauge **#5**, Pressure Gauge **#8**, Duplex Gauge **#15**, Foam Concentrate Manifold **#16**, and Balancing Valve **#12**. Refer to the diagrams for the location of these items.
6. Open foam/water discharge valves and associated metering valves **Item #18 on diagram**, one at a time. Allow water to flow until clear.
7. After flushing, disengage foam pump and shutoff flushing water supply source.
8. Leave all water and foam drains open until water stops flowing.
9. Return all water and foam valves to normal standby operating positions.

Balanced Pressure Foam Proportioning - Operation From External Supply

SPECIAL NOTE: The balancing valve is continually returning extra foam pump output back to tank during foam system operation, as such, this operation can only be performed if the external foam concentrate source is the same as the foam concentrate originally supplied from the on-board tank. **DO NOT MIX BRANDS or TYPES OF FOAM CONCENTRATES WITHOUT CHECKING WITH THE FOAM CONCENTRATE MANUFACTURER**.

1. In the event the apparatus onboard foam concentrate tank supply is depleted, foam concentrate can be supplied from external sources, such as drums, totes, or nurse tanker. This operation requires the installation of the auxiliary foam concentrate intake/flush-in valve **Item #3 on diagram**. Operating balanced pressure proportioning from an external foam supply source is the nearly the same.
2. **SPECIAL NOTATION: This Operation Can Only Be Performed If The External Foam Concentrate Source Is The Same As The Foam Concentrate Originally Supplied From The On-Board Tank. Do Not Mix Brands Or Types Of Foam Concentrates Without Checking With The Foam Concentrate Manufacturer**.
3. Connect the external foam supply to the auxiliary foam concentrate intake/flush-in valve **Item #3 on diagram** and open.
4. If drafting from drums or totes, hose length between the external supply and the apparatus need to be no more then 10-20 feet [3.05-6.10 m] in length, with no more than a 3-4 foot [.91-1.2 m] vertical lift.
5. Close the Tank-to-Pump valve **Item #1 on diagram**.
6. During foam operation, the on-board tank level must be monitored closely, as excess foam concentrate output will be returning to the on-board tank.

Balanced Pressure Foam Proportioning - Operation From External Supply (Continued)

7. If external foam concentrate source is of sufficient quantity, the tank fill valve **Item #10 on diagram**, can be opened slightly to aid in refilling the onboard tank. Foam and water pressure balance must be watched closely to prevent too much foam going to tank and not to the foam/water discharge(s).
8. Once the onboard tank is sufficiently filled, change foam operation back to using the onboard tank.
9. A valved direct tank fill connection is another option for filling the onboard foam tank. Foam concentrate can be pumped into the tank at a more convenient location.
10. Always monitor the foam concentrate tank level during any operation.

Balanced Pressure Foam Proportioning - PTO Selection Guidelines

1. The simplest and least expense approach to operating the foam pump in a balanced pressure proportioning system is by PTO – power take-off from the chassis transmission.
2. Foam pump must be mounted in a convenient location, usually under a chassis frame rail with clear path for the driveline connecting the PTO and the pump. Horsepower requirements of the foam pump must be taken into consideration with sizing the PTO and the interconnecting driveshaft – see Trident performance curves of specific pump selected. Always follow driveshaft manufacturer's recommendations for driveline lengths, operating speeds and operating angles.
3. PTO ratio selection is critical to obtain sufficient foam pump speed at low engine speeds, but not too high of a ratio to overspeed the foam pump at high engine speeds. Most foam pumps have a maximum operating speed of 1800 RPM – see Trident performance curves for specific pump selected. Fire pump operating speeds will vary depending on water supply source. Operating the fire pump from a draft source or on-board water tank may require higher engine speeds, then operating from pressurized water sources, like hydrants.

Balanced Pressure Foam Proportioning - Foam Pump Selection Guidelines

1. The foam pump has one main purpose in a balanced pressure proportioning system – supply foam concentrate under pressure to the ratio controllers on each foam water discharge.
2. When selecting a foam pump size:
   a. Review the allowable injection rates of the planned foam concentrate - 1%, 3%, 6% etc.
   b. Determine the number and flow capacity of each foam/water discharge. If each discharge has foam/water capabilities, then use the maximum capacity of the fire pump to determine foam pump size.
   c. If apparatus is only equipped with a few foam/water discharges, use the total capacities of these discharges to determine foam pump size - a smaller foam pump capacity may be sufficient.
3. Using the maximum capacity of the fire pump, either from draft or pressurized water sources, taking the maximum capacity of the fire pump times the foam concentrate injection rate (1%, 3%, or 6%) will provide a nominal foam pump flow. The same approach can be applied when only equipped with a few foam/water discharges. Refer to our performance curves to select the correct pump capacity.
4. The foam pump may also be used to fill the on-board foam tank, discharge foam concentrate to other containers, or provide pressurized foam concentrate to foam makers not on the apparatus. These applications are typically at lower flows and pressures, but need to be considered.

Balanced Pressure Foam Proportioning - Component Selection Steps

STEP #1: Identify and select the number and flow size of each foam/water discharge to be provided.

   a. Each foam/water discharge requires a ratio controller, matching metering valve and check valve.
   b. The component selection chart indicates available ratio controllers by flow range, correct matching metering valves for each specific ratio controller, and check valve. Indicate required quantities of each in the column to the right.

STEP #2: Every balanced pressure proportioning system requires a Trident #30.054.0 Balancing Valve.

STEP #3: Foam Pump Selection:

   a. Determine foam pump flow capacity as described in Foam Pump Selection Guidelines
   b. Determine foam pump drive mechanism; PTO or Hydraulic. PTO driven pumps are designated with a '**U**' suffix, i.e. **GP30U**. Hydraulic driven pumps are designated with a '**H**' suffix, i.e. **GP120H**.
   c. Foam pump final assembly is based on rotation direction of the drive mechanism. Refer to Trident Foam Pump Ordering Guide #99.011.08 for rotation/porting options and optional shaft positions for PTO driven pump. All hydraulic driven pumps are designed with the drive shaft on the top. The foam pump part number will be designated by the final build configuration. **NOTE:** Pump drive rotation will not affect pump price.

Balanced Pressure Foam Proportioning - Component Selection Steps (Continued)

STEP #4: Relief Valve Selection:

a. A relief valve is required to protect the foam pump and foam concentrate discharge piping from over pressurization. Select relief valve from the chart that matches foam pump selection. See Data Sheet #99.011.03 starting on Page #25 of this guide.

STEP #5: Strainer Selection:

a. A strainer is required near the suction port on all balanced pressure proportioning systems to protect the foam pump rotors from damage by foreign materials. Strainer mesh size should not be less then 1/4" [6.35 mm] to prevent pump cavitation. Strainer size must be same size as pump ports, at a minimum. If the suction piping is oversized due to extra pipe fittings or long pipe run, strainer must be sized to match.

b. Selection chart illustrates strainer sizes to match specific pumps with standard suction piping runs.

STEP #6: Duplex Gauge Selection:

a. A duplex gauge is required to monitor both water and foam pressures and is used by the operator to ensure the foam and water pressures are matched. Trident can provide a 4-1/2" [114.3 mm] liquid filled duplex gauge with faceplate marking of PSI, or dual PSI/BAR, or dual PSI/KPA markings.

STEP #7: Optional Gauge Selection:

a. Trident can offer optional pressure and compound gauges as shown in the piping schematic. Gauges are available in 2-1/2" [63.5 mm] liquid filled with dual PSI/KPA faceplate markings.

STEP #8: Optional Ball Valve Selection:

a. Trident offers a variety of 1/4 turn, manually operated, full port ball valves for use in a balanced pressure proportioning system.

b. See selection chart:

i. 1/4" through 1" [6.35 through 25.4 mm] female NPT available in chrome plated rectangular handle, full port, brass, rated to 600 PSI [41.3 Bar].

ii. 1" through 4" [25.4 through 101.6 mm] female NPT available in manual lever operated, full port, nickel plated brass, rated to 600 PSI [41.3 Bar].

Balanced Pressure Foam Proportioning - Component Checklist

Balanced Pressure Foam Proportioning Component Checklist
For Mobile Equipment Apparatus
Components Available from Trident Emergency Products

Foam Concentrate Proportioner/Ratio Controller
(One required for each foam/water discharge)
See Product Data Sheet #99.011.06 for Full Product Details

Ratio Controller Size			Foam/Water Solution Flow Range		Typical Discharge Application		Quantity Required
Inch	Metric	Part Number	GPM	LPM		See Item #19 on Piping Schematic Located on Pages 4 or 5	
2.0"	50.8 mm	31.004.1	60-200	227-757	Crosslay/Speedlay		
2.5"	63.5 mm	31.004.2	100-320	378-1211	Side or Rear		
3.0"	76.2 mm	31.004.3	170-625	643-2365	Side or Monitor		
4.0"	101.6 mm	31.004.4	350-1200	1325-4542	Monitor or LDD		

Foam Concentrate Metering Valve
(One required for each foam/water discharge)
See Product Data Sheet #99.011.07 for Full Product Details

Metering Valve Size			Use with Matching Ratio Controller				Quantity Required
Inch	Metric	Part Number	Part #	Inch	Metric	See Item #18 on Piping Schematic Located on Pages 4 or 5	
2.0"	50.8 mm	30.039.10	31.004.1	2.0"	50.8 mm		
2.5"	63.5 mm	30.039.11	31.004.2	2.5"	63.5 mm		
3.0"	76.2 mm	30.039.12	31.004.3	3.0"	76.2 mm		
4.0"	101.6 mm	30.039.13	31.004.4	4.0"	101.6 mm		

Foam Concentrate Check Valves
(One required for each foam/water discharge)
See Product Data Sheet #99.011.4 for Full Product Details

Quantity Required

Check Valve Size Inch	Check Valve Size Metric	Part Number	Matching Metering Valve		
1.5"	38.1 mm	30.063.0	30.039.10	The ratio controller, metering valve and check valve are a matched set. Cv value of check valve must exceed the maximum foam concentrate flow of the selected metering valve shown on Page #9. Trident offers check valves that are matched to each metering valve size.	See Item #17 on Piping Schematic Located on Pages 4 or 5
1.5"	38.1 mm	30.063.0	30.039.11		
1.5"	38.1 mm	30.063.0	30.039.12		
1.5"	38.1 mm	30.063.0	30.039.13		

Foam Concentrate Balancing Valve
See Product Data Sheet #99.011.01 for Full Product Details

Quantity Required

Balancing Valve Size Inch	Balancing Valve Size Metric	Part Number	Foam Concentrate Flow Range GPM	Foam Concentrate Flow Range LPM		
2"	50.8 mm	30.054.0	10-250	38-946		See Item #12 on Piping Schematic Located on Pages 4 or 5

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Trident GP Series Positive Displacement Foam Pump
See Item #6 on Piping Schematic
(One required for each balanced pressure installation)
See Foam Pump Technical Manual #99.013.1 for GP30 and GP60 Pumps
See Foam Pump Technical Manual #99.013.2 for GP120 through GP300 Pumps

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Pump Model Series **PTO Drive**	Part Number*	Pump Flow 250 PSI [17.2 BAR] @ 1800 RPM		Foam/Water Solution Flow Capacity Based on Foam Pump Capacity GPM LPM						Quantity Required
		GPM	LPM	1%		3%		6%		
GP30U	31.018.xx	27	102	2,700	10,200	900	3,400	450	1,700	
GP60U	31.021.xx	73	276	7,300	27,600	2,430	9,200	1,215	4,600	
GP120U	31.017.xx	120	454	12,000	45,400	4,000	15,000	2,000	7,500	
GP160U	31.007.xx	160	606	16,000	60,500	5,300	20,000	2,650	10,000	
GP200U	31.016.xx	215	814	21,500	81,000	7,160	27,000	3,580	13,500	
GP300U	31.006.xx	310	1173	31,000	117,300	10,300	38,900	5,160	19,500	
Pump Model Series **Hydraulic Drive**	Part Number*	Pump Flow 250 PSI (17.2 BAR) @ 1800 RPM		Foam/Water Solution Flow Capacity Based on Foam Pump Capacity GPM LPM						Quantity Required
		GPM	LPM	1%		3%		6%		
GP30H	31.018.xx	27	102	2,700	10,200	900	3,400	450	1,700	
GP60H	31.021.xx	73	276	7,300	27,600	2,430	9,200	1,215	4,600	
GP120H	31.017.xx	120	454	12,000	45,400	4,000	15,000	2,000	7,500	
GP160H	31.007.xx	160	606	16,000	60,500	5,300	20,000	2,650	10,000	
GP200H	31.016.xx	215	814	21,500	81,000	7,160	27,000	3,580	13,500	
GP300H	31.006.xx	310	1173	31,000	117,300	10,300	38,900	5,160	19,500	

*Final Foam Pump part number will depend on pump build configuration. See Foam Pump Ordering Guide, Form #99.011.08 for detailed information and pump model selection. Pumps are non-UL® marked.

Foam Pump Relief Valve (One required for each balanced pressure installation) See Product Data Sheet #99.011.03 for Full Product Details.						Quantity Required
Valve Size Inch	Valve Size Metric mm	Part Number*	Matching Foam Pump Model	See Item #7 on Piping Schematic Located on Pages 4 or 5		
.75" x .75"	19.0 x 19.0	30.071.0.275	GP30 and GP60			
1.5" x 1.5"	38.1 x 38.1	30.067.0.275	GP120 and GP160			
1.5" x 2.0"	38.1 x 50.8	30.067.1.275	GP200			
1.5" x 2.5"	38.1 x 63.5	30.067.2.275	GP300			
*Relief Valve set pressure of 275 PSI (19 BAR)						
Foam Pump Suction Strainer (One required for each balanced pressure installation)				Item #4 on Piping Schematic Located on Pages 4 or 5 		Quantity Required
Strainer Size Inch	Strainer Size Metric mm	Part Number	Matching Foam Pump Model	Rating and Materials of Construction		
FNPT						
1.0"	25.4	21.003.2		Class 125, Bronze, Stainless Steel Strainer		
1.5"	38.1	21.003.3	GP30	Class 125, Bronze, Stainless Steel Strainer		
2.0"	50.8	21.003.4	GP60 and GP120	Class 125, Bronze, Stainless Steel Strainer		
2.5"	63.5	21.003.5		Class 125, Bronze, Stainless Steel Strainer		
3.0"	76.2	21.003.6	GP160 and GP200	Class 125, Bronze, Stainless Steel Strainer		
RF Flanged						
2.5"	63.5	21.003.7		Class 150, All Stainless Steel		
3.0"	76.2	21.003.8	GP160 and GP200	Class 150, All Stainless Steel		
4.0"	101.6	21.003.9	GP300	Class 150, All Stainless Steel		
5.0"	127	21.003.10	GP300	Class 150, All Stainless Steel		
6.0"	152.4	21.003.11		Class 150, All Stainless Steel		
Rigid Male NPT Pipe x Victaulic™ Adapters Cast Brass Construction						Quantity Required
Adapter Size Inch	Adapter Size Metric mm	Part Number	Lug Type	Description		
1.0" x 1.0"	25.4 x 25.4	09.017.6	Internal	Male NPT x Victaulic in Cast Brass		
1.5" x 1.5"	38.1 x 38.1	09.017.0	Internal	Male NPT x Victaulic in Cast Brass		
2.0" x 2.0"	50.8 x 50.8	09.017.1	Internal	Male NPT x Victaulic in Cast Brass		
2.5" x 2.5"	63.5 x 63.5	09.017.2	Internal	Male NPT x Victaulic in Cast Brass		
3.0" x 3.0"	76.2 x 76.2	09.017.3	Internal	Male NPT x Victaulic in Cast Brass		
4.0" x 4.0"	101.6 x 101.6	09.017.4	Internal	Male NPT x Victaulic in Cast Brass		
5.0" x 5.0"	127 x 127	09.017.5	Internal	Male NPT x Victaulic in Cast Brass		

Duplex Pressure Gauge (One required for each balanced pressure installation)					Quantity Required
Gauge Size Inch	Gauge Size Metric mm	Part Number	Details		
4.5"	114.3	14.012.0	0-400 PSI Back Mount Liq. Filled	See Item #15 on Piping Schematic Located on Pages 4 or 5	
4.5"	114.3	14.012.1	0-400 PSI/BAR Back Mount Liq. Filled		
4.5"	114.3	14.012.2	0-400 PSI/KPA Back Mount Liq. Filled		
Optional Pressure and Compound Gauges (One optional for each balanced pressure installation)				 	Quantity Required
Gauge Size Inch	Gauge Size Metric mm	Part Number	Details		
2.5"	63.5	14.012.5	**Pressure Gauge** 0-400 PSI/KPA Back Mount Liq. Filled	See Items #5 and #8 on Piping Schematic Located on Pages 4 or 5	
2.5"	63.5	14.012.6	**Compound Gauge** 30-0-400 PSI/KPA Back Mount Liq. Filled		
Optional Ball Shutoff Valves					Quantity Required
Valve Size Inch	Valve Size Metric mm	Part Number	Description		
.25"	6.35	30.008.1	Manually operated, chrome rectangular handle, full port, brass. Maximum operating pressure of 600 PSI [41.3 BAR].		
.375"	9.53	30.018.1			
.50"	12.7	30.007.1			
.75"	19.1	30.006.1			
1.0"	25.4	30.022.1			
See Product Data Sheet #99.011.5 for Full Product Details on the Following Valves.					Quantity Required
Valve Size Inch	Valve Size Metric mm	Part Number	Description		
1.0"	25.4	30.056.0	Manual lever operated, full port, nickle plated brass. Maximum operating pressure of 600 PSI [41.3 BAR].		
1.5"	38.1	30.057.0			
2.0"	50.8	30.058.0			
2.5"	63.5	30.059.0			
3.0"	76.2	30.060.0			
4.0"	101.6	30.061.0			

Provide Trident with this list and we will quickly return with a quotation and approximate delivery period.

Industrial Pumper Photos

Product Data Sheets

The remaining pages in this booklet contain various Product Data Sheets. They are listed below.

Ratio Controller #99.011.06

A ratio controller operates on a modified venturi principal in that water entering the device passes through an orifice jet at the water inlet. In conjunction with the orifice jet, the design of the ratio controller body creates a low-pressure area between the orifice jet and the receiver area. This allows foam concentrate of the same pressure as the water supply to enter the device and mix with the water stream. As water flow increases or decreases through the orifice jet, there is a corresponding increase or decrease in differential pressure, allowing a proportional increase or decrease in foam concentrate flow into the water stream.

Trident 2", 2.5", 3" and 4" [50.8, 63.5, 76.2 and 101.6 mm] ratio controllers, or proportioning devices, are designed to accurately inject pressurized foam concentrate into a water stream with minimal pressure loss, over a wide range of flows and pressures, when used in conjunction with the matching foam concentrate metering valve. Proper proportioning of foam concentrate into the water stream is maintained through the operating range of the ratio controller, without any manual adjustment to the device, by simply maintaining a balanced pressure between the water and foam concentrate. Trident ratio controllers are compatible with any type of foam concentrate, including fluoroproteins, thixotropic, and fluorine-free. See data below for operating flow ranges, dimensional information, friction loss curves and minimum inlet pressure.

Design Features:

- ► Automatic operation when used in conjunction with the matching foam concentrate metering valve.
- ► A recovery area downstream of the receiver reduces friction loss through the device.
- ► All bronze and stainless steel construction.
- ► Suitable for all types of foam concentrates, including fluoroproteins, thixotropic and fluorine-free.
- ► Will operate with fresh, brackish or seawater.
- ► Can be installed in any position for system versatility.
- ► Designed to be mounted using standard pipe groove coupling (Victaulic™ or equal).
- ► Plugged 1/8" [3.17] F NPT ports are provided for monitoring of inlet water and foam pressures.

Applications:

Demand type or standard balanced pressure foam systems on mobile apparatus in conjunction with the matching foam concentrate metering valve.

Specifications:

The ratio controller shall be of all bronze and stainless steel construction with standard pipe groove connections for water inlet and foam solution outlet and female NPT foam concentrate connection. The body shall be of alloy C83600 cast brass, ASTM B-584 and the orifice jet shall be of alloy C36000 yellow brass retained with a 300 series stainless steel snap ring. The orifice jet shall be specially machined to minimize constriction of the inlet water stream and maximize water velocity through the device. Each ratio controller size is rated to a working pressure of 250 PSI [17.2 BAR] and hydrostatically tested to 500 PSI [34.5 BAR]. To minimize pressure loss through the ratio controller a recovery area shall be incorporated into the device design downstream of the receiver area.

Technical Data:

Materials of Construction:

- ► Body: Alloy C83600 Cast Bronze, ASTM B-584.
- ► Orifice Jet: Alloy C36000 Yellow Brass.
- ► Snap Ring: 300 Series Stainless Steel.

Technical Data (Continued)

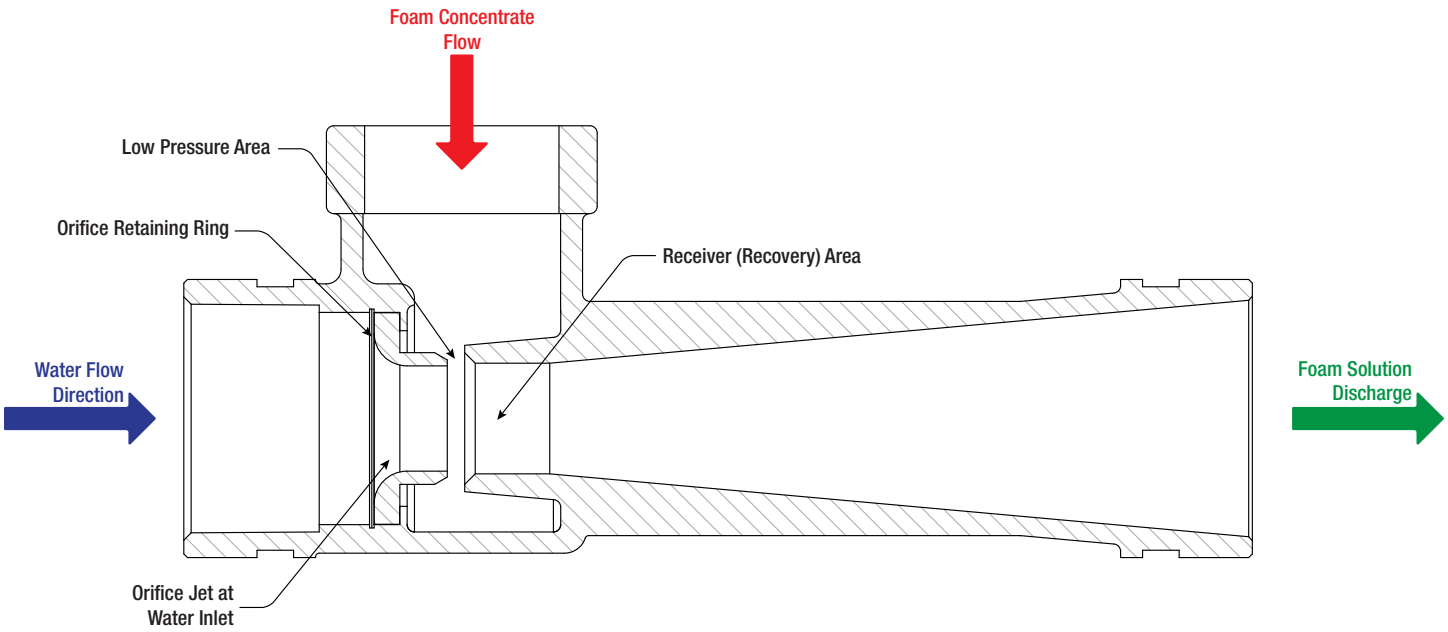
- Flow Range: See chart below for the flow range of each of the ratio controller sizes.
- Minimum Water Inlet Pressure: 30 PSI [2 BAR].
- Maximum Operating Pressure Rating: 250 PSI [17.2 BAR].
- Maximum Operating Temperature Rating: 150°F [66°C].
- Water Inlet and Foam Solution Outlet Connections: Standard Pipe Groove, Victaulic™ or equal.
- Foam Concentrate Inlet Connection: Female NPT.
- Dimensions and Weights: See chart below for dimensional .information and weight for each of the Ratio Controllers.
- Finish: Standard brass finish as cast and machined, unpainted.

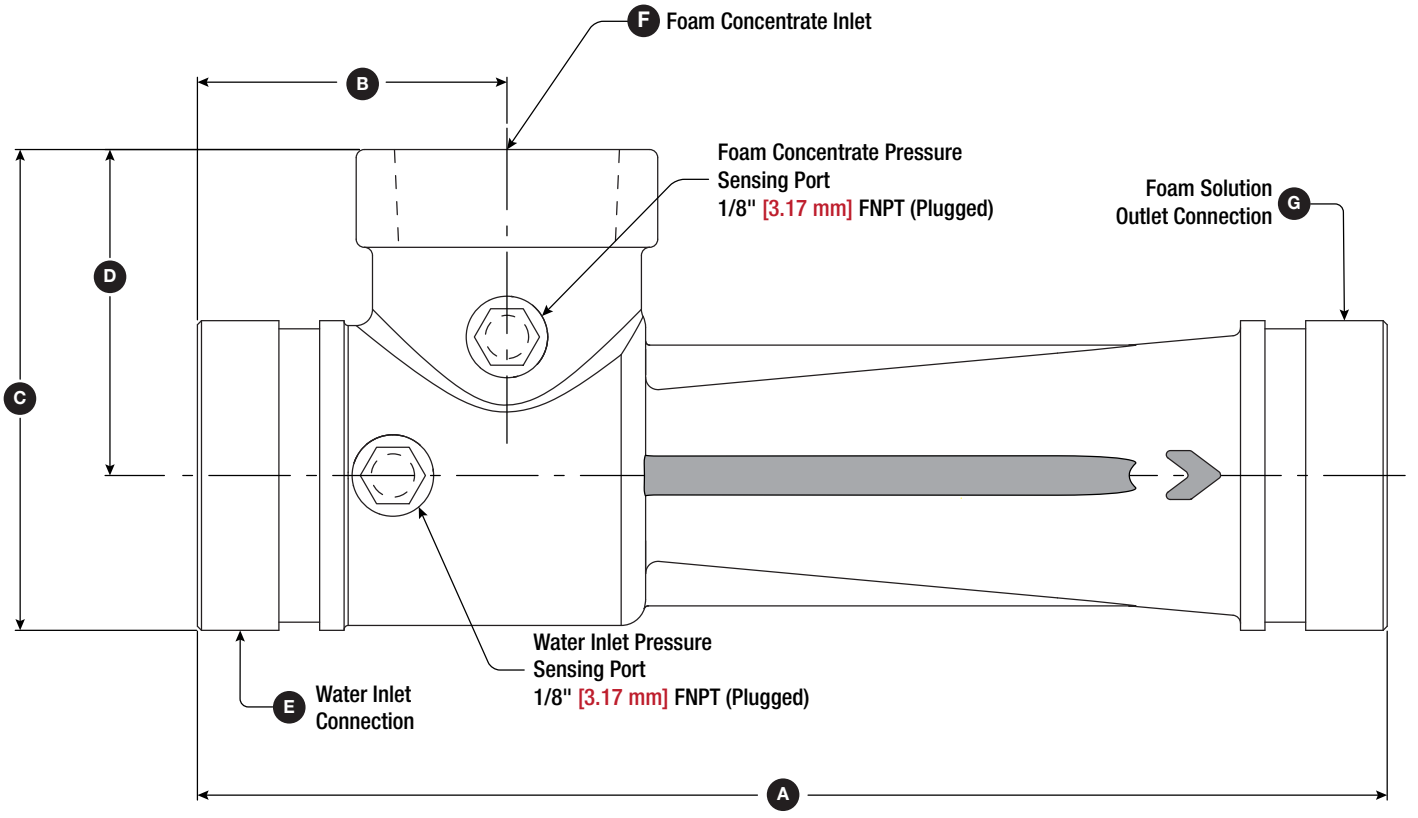
Complementary System Components

Foam Metering Valves for Ratio Controller			Foam System Balancing Valve	Foam Pump
Controller Size		Part Number		
2.0"	50.8 mm	30.039.10	2" [50.8 mm] Balanced Pressure Foam System Water/Foam Balancing Valve: Part Number 30.054.0	GP Series™ positive displacement, rotary gear foam pumps are available in sizes for most foam systems. Contact Trident Emergency Products for details.
2.5"	63.5 mm	30.039.11		
3.0"	76.2 mm	30.039.12		
4.0"	101.6 mm	30.039.13		
See Trident Product Data Sheet #99.011.07 for Metering Valve Details				
See Trident Product Data Sheet #99.011.01 for Balancing Valve Details				

Ratio Controller Flow Range Chart

For Balanced Pressure Systems (Pump Type)		All Foam Concentrate Types: 1%, 3% or 6%	
Ratio Controller Size		GPM	LPM
2.0"	50.8 mm	60-200	227-757
2.5"	63.5 mm	100-320	378-1211
3.0"	76.2 mm	170-625	643-2365
4.0"	101.6 mm	350-1200	1325-4542



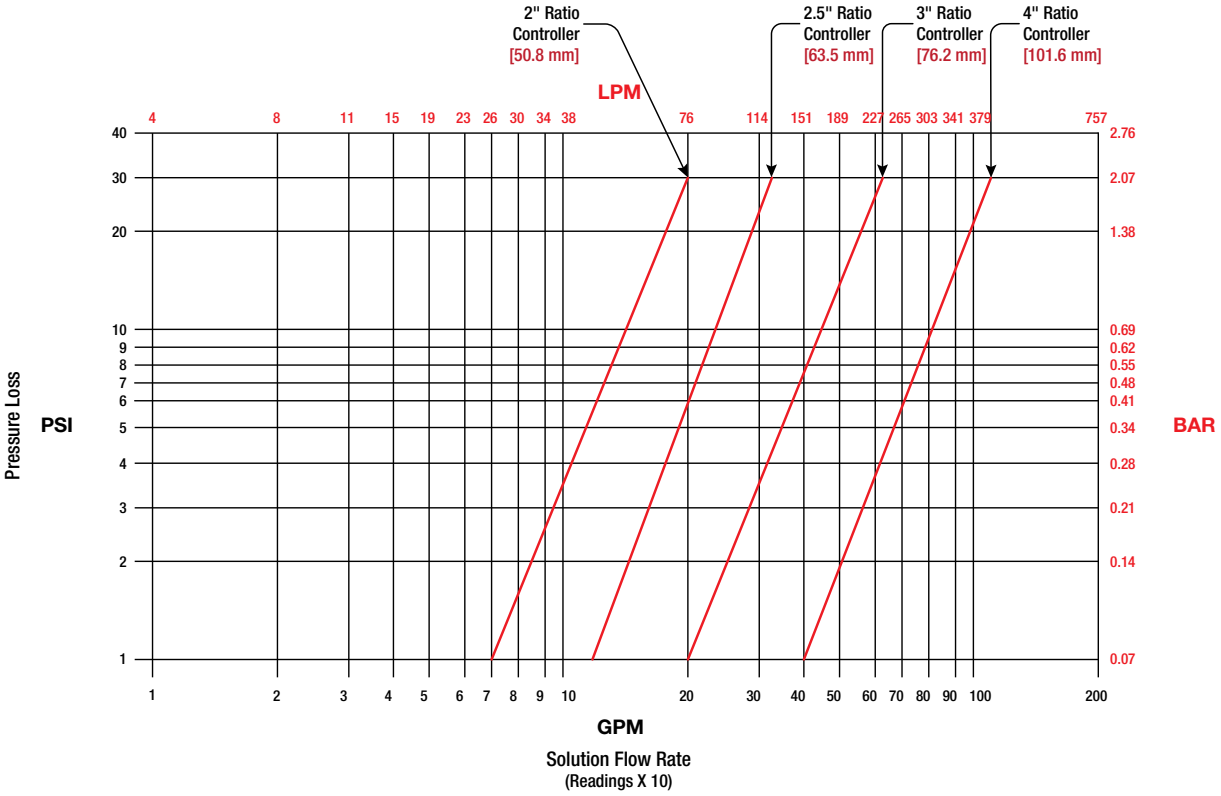


Dimensional Data - US [Metric]									
Trident Ratio Controller		A	B	C	D	E	F	G	Weight US Pounds Kilograms
Part Number Inch	Part Number Metric	Length	Distance to Pressure Sensing Port	Overall Height	Distance from Outside of Foam Inlet to Center	Water Inlet Port Grooved	Foam Inlet Port F NPT	Foam Outlet Port Grooved	Lbs. [kG.]
2.0"	50.8 mm	9.13" [231.8mm]	2.38" [60.3mm]	3.56" [90.5mm]	2.38" [60.3mm]	2.00" [50.8mm]	1.25" [31.7 mm]	2.00" [50.8mm]	5 Lbs. [2.2 kG.]
31.004.1									
2.5"	63.5 mm	6.88" [174.6mm]	2.25" [57.2mm]	3.81" [96.8mm]	2.38" [60.3mm]	2.50" [63.5mm]	1.00" [25.4 mm]	2.50" [63.5mm]	5 Lbs. [2.2 kG.]
31.004.2									
3.0"	76.2 mm	12.13" [308.0mm]	4.00" [101.6mm]	5.06" [128.6mm]	3.31" [84.1mm]	3.00" [76.2mm]	1.50" [38.1 mm]	3.00" [76.2mm]	12 Lbs. [5.4 kG.]
31.004.3									
4.0"	101.6 mm	11.00" [279.4mm]	3.00" [76.2mm]	6.25" [158.7mm]	4.00" [101.6mm]	4.00" [101.6mm]	2.00" [50.8 mm]	4.00" [101.6mm]	17 Lbs. [7.7 kG.]
31.004.4									

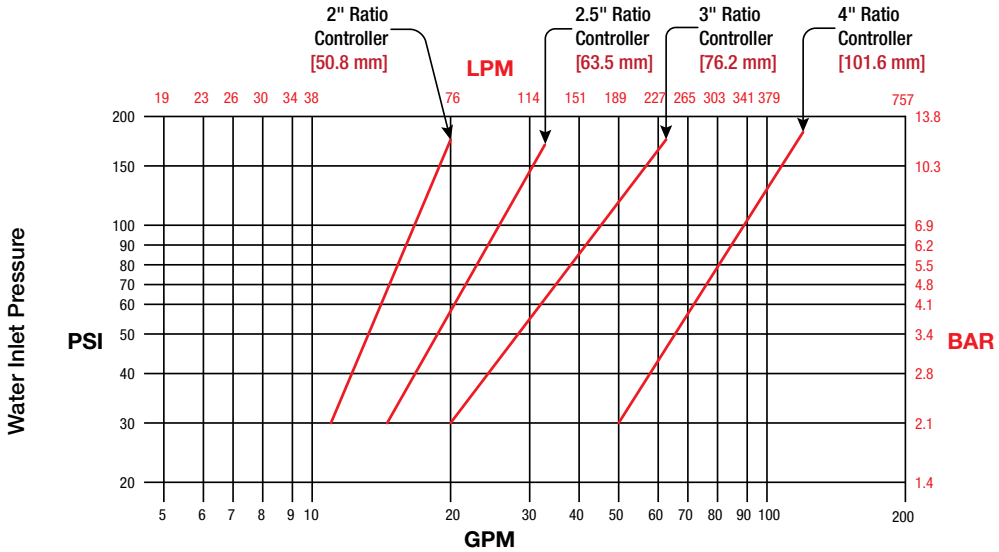
NOTES:

1. For optimal performance, a minimum length of straight unobstructed pipe, five (5) times of the same diameter pipe being used, is required upstream and downstream of the ratio controller.
2. Piping designs shall include a means to remove ratio controller from the plumbing.
3. All piping to and from the ratio controller, including foam concentrate lines, must be properly supported and secured, so as to place no strain on the ratio controller.

Friction Loss Curves



Minimum Inlet Pressure versus Water Flow



Metering Valves #99.011.07

The foam concentrate metering valve is utilized in conjunction with a Trident ratio controller to control the foam injection percentage (%). The metering valve acts as an adjustable orifice that can be set and calibrated with a specific ratio controller to compensate for losses within the foam concentrate piping, creating accurate injection across the ratio controller's flow range. Each metering valve is sized to match the flow requirements of the specific size ratio controller and can be calibrated for up to 6% injection rates.

Each metering valve is a right angle type device with positive shut-off capabilities. Metering valve mounting locations are located between the foam concentrate source (downstream of the foam pump) and the foam/water discharge ratio controller. All valves are easily installed using industry standard pipe groove connections (Victaulic™).

Design Features:

- Manually adjustable for flow rates up to 6% injection, when used with matching ratio controller.
- All bronze and stainless steel construction with stainless steel fasteners.
- Suitable for all types of foam concentrates, including fluoroproteins, thixotropic, and fluorine-free.
- Will operate with fresh, brackish or seawater.

Applications:

Demand type or standard balanced pressure foam systems on mobile apparatus in conjunction with the matching foam concentrate ratio controller.

Specifications:

The metering valve shall be of all bronze and stainless steel construction with stainless steel fasteners, and body machined with standard pipe groove connections. The body shall be of alloy C83600 cast brass, the metering plug, cap and valve shaft shall be machined from brass alloy 360, and all sealing O-Rings shall be EPDM. Each metering valve size is rated to a working pressure of 250 PSI [17.2 bar] and hydrostatically tested to 500 PSI [34.5 BAR].

Technical Data:

Materials of Construction:

- Metering Valve Body: Alloy C83600 Cast Bronze, ASTM B-584.
- Flow Control Metering Plug: Brass Alloy 360.
- Metering Valve Shaft: Brass Alloy 360.
- Metering Valve Cap: Brass Alloy 360.
- O-Rings: EPDM.
- Spring: Stainless Steel.
- Fasteners: Stainless Steel.
- Knob: Black Phenolic.

Technical Data (Continued)

- Flow Range: See chart below for flow range of each size metering valve.
- Maximum Operating Pressure Rating: 250 PSI [17.2 BAR].
- Maximum Operating Temperature Rating: 150°F [66°C].
- Piping connections: Standard pipe groove (Victaulic or equal).
- Dimension and Weight: See chart below for dimensional information and weight of each size of Metering Valve.
- Finish: Standard brass finish as cast and machined, unpainted.

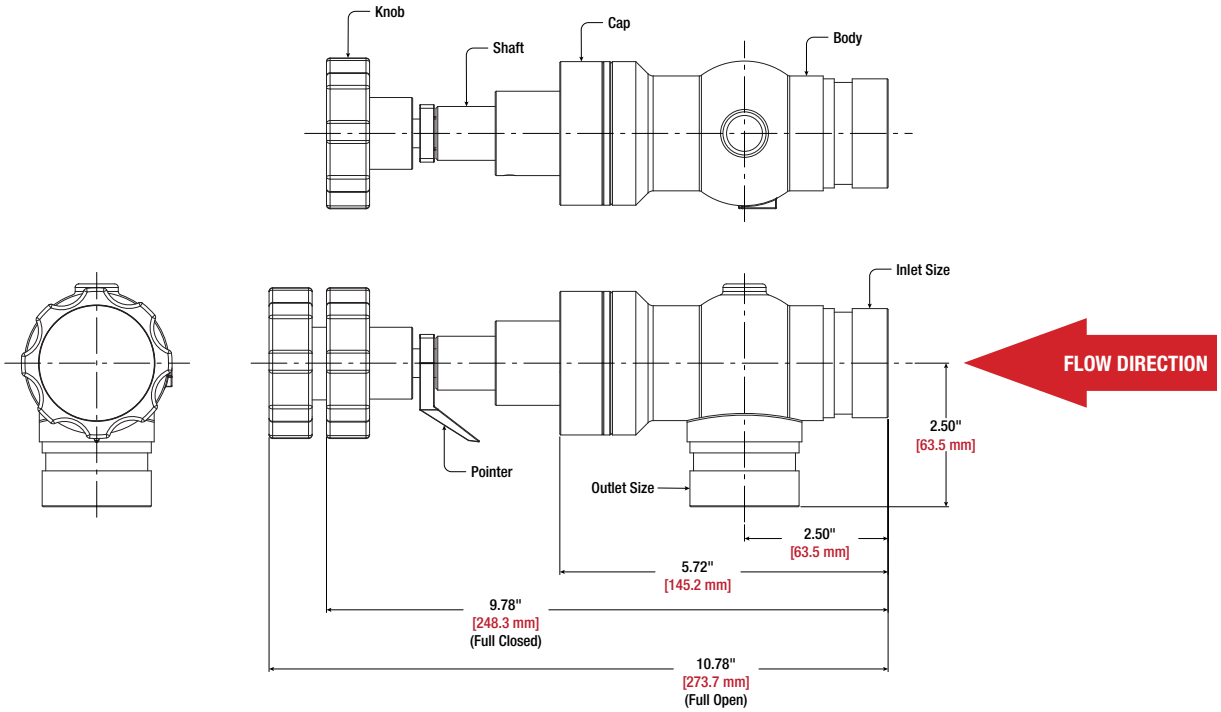
Complementary System Components

Ratio Controller and Metering Valves Pairing and Flow Ranges						Foam System Balancing Valve	Foam Pump
Ratio Controller	Metering Valve	Size		GPM Flow	LPM Flow		
		Inch	Metric				
31.004.1	30.039.10	2.0"	50.8 mm	60-200	227-757	2" [50.8 mm] Balanced Pressure Foam System Water/ Foam Balancing Valve: Part Number 30.054.0	GP Series™ positive displacement, rotary gear foam pumps are available in sizes for most foam systems. Contact Trident Emergency Products for details.
31.004.2	30.039.11	2.5"	63.5 mm	100-320	378-1211		
31.004.3	30.039.12	3.0"	76.2 mm	170-625	643-2365		
31.004.4	30.039.13	4.0"	101.6 mm	350-1200	1325-4542		
See Trident Product Data Sheet #99.011.06 for Ratio Controller Details							
See Trident Product Data Sheet #99.011.01 for Balancing Valve Details							

Metering Valve Dimensions and K Factor Chart

Model			Pipe Groove Size				Weight	
Size		Part #	Inlet		Outlet		Lbs.	Kg.
2.0"	50.8 mm	30.039.10	1.50"	38.1 mm	1.00"	25.4 mm	4.0	1.81
2.5"	63.5 mm	30.039.11	1.50"	38.1 mm	1.00"	25.4 mm	4.0	1.81
3.0"	76.2 mm	30.039.12	1.50"	38.1 mm	1.50"	38.1 mm	5.0	2.26
4.0"	101.6 mm	30.039.13	1.50"	38.1 mm	1.50"	38.1 mm	5.0	2.26

Generic Foam K Factor Chart	
Concentrate Type	K Factor
Fluoroprotein	0.85
AR-AFFF	0.87
AFFF	0.95
Fluorine Free	0.92



NOTES:

1. Piping designs shall include a means to remove metering valve from the plumbing for service.
2. All piping to and from the metering valve must be properly supported and secured, so as to place no strain on the valve.
3. Refer to current editions of NFPA 11 – Standard for Low, Medium and High Expansion Foam and NFPA 20 – Standard for the Installation of Stationary Pumps for Fire Protection for any applicable foam or foam system requirements.

Metering Valve Calibration

Each metering valve must be calibrated after installation to set the injection percentage (%) points – typically 1%, 3% and 6%. Calibration is done by establishing a known water flow through each foam/water discharge, while operating the balanced pressure foam system to measure the flow through the corresponding metering valve to determine a position on the calibration plate for each injection percentage point.

Typical Calibration Steps:

1. Establish a known water flow through a foam/water discharge. For this example, we will use 500 GPM [1892 LPM].
2. Operate the balanced pressure foam concentrate proportioning system to establish a flow through the foam pump. With Trident GP Series™ foam pumps, this testing and calibration can be done with water.
3. Open the foam metering valve for the corresponding foam/water discharge and confirm foam pump discharge pressure matches water pump discharge pressure.
4. For the ease of testing and calibration, the foam pump testing medium supply can be connected to the valved auxiliary foam concentrate intake/flush-in connection shown in the piping schematic below. This will allow testing and calibration using a medium other than what may be stored in the foam tank. Ensure foam *Tank-to-Pump* and foam *Pump-to-Tank* valves are closed.
5. Based on required foam injection percentage rates, determine required flow through metering valve at each injection point. For this example, we will use 1%, 3% and 6%. Per the current NFPA 20 standard on Class B foam proportioning system accuracy, injection rate tolerances are -0/+30% or 1%, whichever is less. It is common practice to set metering valve injection points halfway through this tolerance range to ensure the system will not operate in a lean condition. Sample flow rates based on 500 GPM [1892 LPM] discharge flow:
   - 1% Injection: 500 GPM [1892 LPM] x 0.0115 (Injection Rate) ÷ (K-Factor) = 6.5 GPM [24.6 LPM] flow rate through metering valve
   - 3% Injection: 500 GPM [1892 LPM] x 0.035 (Injection Rate) ÷ (K-Factor) = 20 GPM [75.7 LPM] flow rate through metering valve
   - 6% Injection: 500 GPM [1892 LPM] x 0.065 (Injection Rate) ÷ (K-Factor) = 37 GPM [140.0] flow rate through metering valve

   The K-Factor is a correction factor between the viscosity of water and foam concentrate when operating with ratio controllers in a balanced pressure foam system. **Refer to Page 19 for K Factor Chart. Contact Foam Concentrate Supplier for exact value.**
6. With a metering valve test calibration plate attached to the face of the metering valve, similar to sample shown on Page 21, open the metering valve until the required flow for 1% injection rate is reached. Record the degree setting from the test calibration plate – this will be the location for the 1% injection point. Repeat this process for the 3% and 6% injection points. As the flow rates through the metering valve can be low for small discharges at low injection percentages, it is recommended to use a flowmeter of high accuracy to determine metering valve flows.
7. As the injection rate into the ratio controller is linear through the flow range of the device, repeat this process for each foam/water discharge at two to three flow points within the range of the ratio controller to verify injection percentage point. Only operate one foam/water discharge and corresponding metering valve at a time.
8. A metering valve calibration plate can be made and attached to each metering valve, similar to sample plate shown below. Calibration plates can be color coded to match discharge plates, if desired.

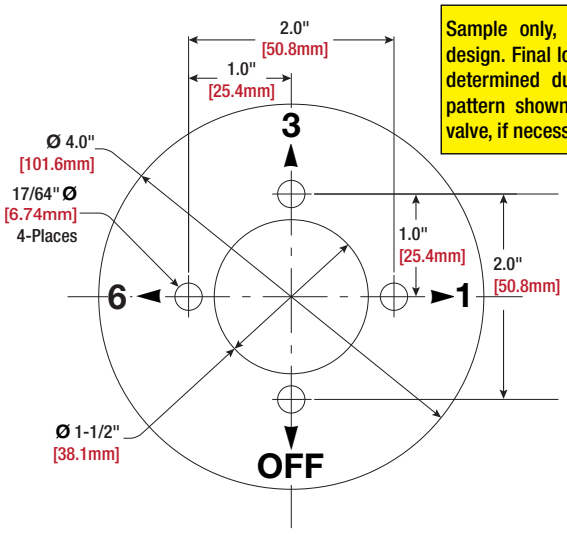
Sample Metering Valve Flow Rate Test Chart

Discharge: #1 Left Side Discharge	**Ratio Controller:** 3.0" [76.2 mm]
Metering Valve Size: 1-1/2" x 1-1/2" for 3" Ratio Controller	**Nominal Flow:** 500 GPM [1892 LPM]
Metering Valve Size: 38.1mm x 38.1mm for 76.2 mm Ratio Controller	**Flow Measuring Devices:**
Nameplate Color:	

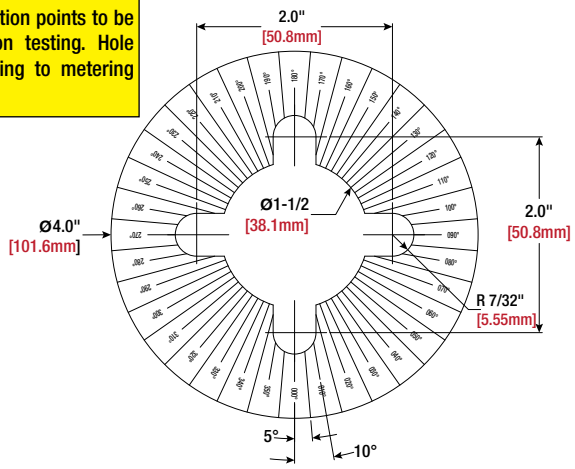
Nominal Foam/Water Discharge Flow @ 150 PSI [10.3 BAR]		Metering Valve Injection Point (%)		K Factor	*Metering Valve Flow Rate (Water)		Metering Valve Degree Setting
500 GPM	1892 LPM	1.15	1%	See Chart on Page 19	6.5 GPM	24.6 LPM	
500 GPM	1892 LPM	3.5	3%	See Chart on Page 19	20 GPM	75.7 LPM	
500 GPM	1892 LPM	6.5	6%	See Chart on Page 19	37 GPM	140.0 LPM	

*(Discharge Flow Rate x Injection %) / K Factor = Metering Valve Flow Rate. **Example:** (500 GPM [1892 LPM] x .0115) ÷ K Factor = 6.5 GPM [24.6 LPM]

Sample only, not intended to be the final design. Final location of injection points to be determined during calibration testing. Hole pattern shown is for mounting to metering valve, if necessary.



Final Calibration Plate - Installer Supplied



Test Calibration Plate - Supplied With Valve

The above image of Final Calibration Plate is for reference purposes only. The exact location of the 1%, 3% and 6% markings will be determined by calibration test result discussed on previous page.

Balancing Valve 2" [50.8 mm] #99.011.01

The 2" [50.8 mm] Balancing Valve is the key component in a balanced pressure type foam proportioning system. The Balancing Valve maintains a balanced foam concentrate pressure to that of the water supply pressure at the inlet of the foam proportioner (ratio controller). Balanced pressure between the water supply inlet and the foam concentrate pressure at the balancing valve is controlled by the amount of foam concentrate the balancing valve regulates and returns to the foam storage tank. The Balancing Valve utilizes an extremely simple design to obtain a balanced water to foam concentrate pressure, providing reliability and repeatability – a design of only two internal moving parts.

A spring-loaded piston within the Balancing Valve assembly moves as inlet water supply pressure at the proportioner increases or decreases, controlling the foam pressure at the valve by regulating the amount of foam concentrate returned to the storage tank. As water pressure increases, the valve piston responds by decreasing the amount of foam concentrate allowed to return to the storage tank, thus increasing the pressure and flow from the foam pump to the inlet of the foam proportioner. As the water pressure decreases, the valve piston responds by allowing an increased flow of foam concentrate back to tank, lowering the foam concentrate pressure and flow to the foam proportioner. The Balancing Valve operation is completely automatic, requiring no manual activation.

Design Features:

- Automatic operation – no manual interface required.
- Bronze and stainless steel construction.
- Suitable for all types of foam concentrates, including fluoroproteins and thixotropic types.
- Will operate with fresh, brackish, or seawater.
- Water chamber and foam concentrate chamber sealed to prevent foam dilution.
- Only two internal moving parts.
- Water drain and pressure ports.
- Single EPDM piston U-Cup seal.

Applications:

Pressure control of foam proportioners (ratio controllers) in balanced pressure foam proportioning systems.

Specifications:

The Balancing Valve shall consist of a cast bronze body with two (2) 2" [50.8 mm] F NPT foam concentrate ports. Port areas are cast with 3" [76.2 mm] hex wrench flats. Body shall include two (2) 1/4" [6.35 mm] F NPT ports in the water chamber area for pressure sensing and drainage.

A machined brass alloy valve piston shall slide internally within the valve body regulating foam flow and pressure to the proportioner. A EPDM U-Cup seal creates separate sealed water and foam chambers within the valve body.

The cast bronze body cap shall be machined with a 1/2" [12.7 mm] F NPT water pressure port and an O-Ring groove to prevent water leakage. Cap will incorporate 1.25" [31.8 mm] hex wrench flats. Cap will be secured in place with a stainless steel snap ring.

A stainless steel spring will be installed in the water chamber side of the valve assembly between the cap and the valve piston to assist in pressure balancing between the water and foam concentrate. The spring will position the valve piston to a “no flow” position when water supply and foam concentrate pressures drops to zero.

Technical Data:

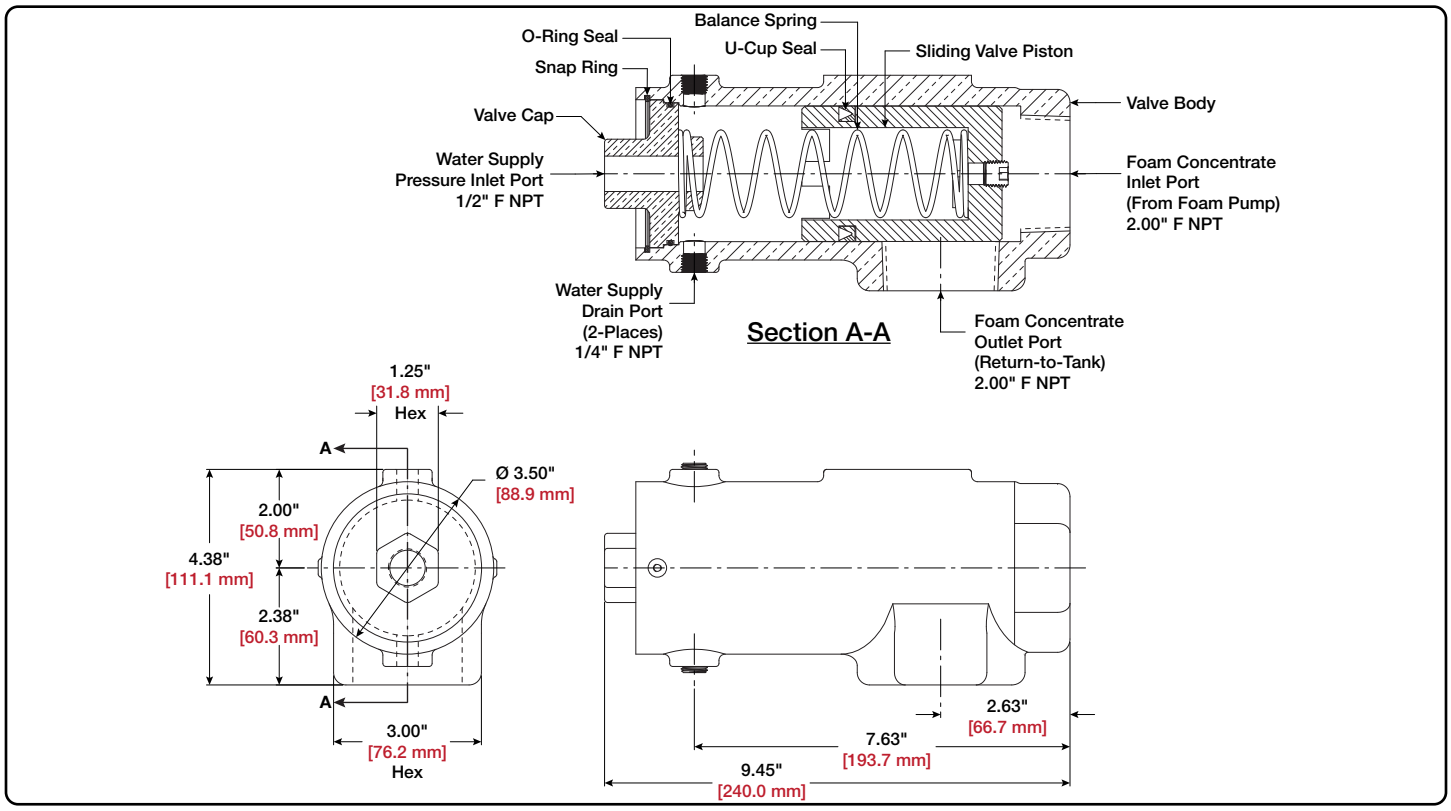
Materials of Construction:

- **Body**: C83600 Cast Bronze.
- **Valve Piston**: 360 Alloy Brass.
- **Piston U-Cup Seal**: EPDM, 70-Durometer.
- **Cap**: C83600 Cast Brass.
- **O-Ring**: EPDM.
- **Snap Ring**: 300 Series Stainless Steel.
- **Spring**: 300 Series Stainless Steel.

Device Details:

- **Flow Range**: 10-250 GPM [38-946 LPM].
- **Piping Connections**: All female NPT, per drawing.
- **Maximum Operating Pressure Rating**: 300 PSI [20.7 BAR].
- **Hydrostatic Pressure Test:** 600 PSI [41 BAR].
- **Maximum Operating Temperature Rating**: 150°F [66°C].
- **Assembly Weight**: 17 LBS. [7.7 kg.].
- **Finish**: None, as cast.

For Details, See the Dimensions and Installation Diagrams on the following two pages.


Balance Spring
O-Ring Seal
U-Cup Seal
Sliding Valve Piston
Snap Ring
Valve Body
Valve Cap
Water Supply
Pressure Inlet Port
1/2" F NPT
Foam Concentrate
Inlet Port
(From Foam Pump)
2.00" F NPT
Water Supply
Drain Port
(2-Places)
1/4" F NPT
Section A-A
Foam Concentrate
Outlet Port
(Return-to-Tank)
2.00" F NPT
1.25"
[31.8 mm]
Hex
A
Ø 3.50"
[88.9 mm]
2.00"
[50.8 mm]
4.38"
[111.1 mm]
2.38"
[60.3 mm]
A
3.00"
[76.2 mm]
Hex
2.63"
[66.7 mm]
7.63"
[193.7 mm]
9.45"
[240.0 mm]

Check Valve #99.011.4

Class 150S bronze, horizontal swing type check valve with female NPT threaded piping connections.

Design Features:

- ► All wetted parts are cast bronze or brass.
- ► Suitable for all types of foam concentrates, including fluoroproteins and thixotropic types.
- ► Will operate with fresh, brackish, or seawater.
- ► Valve body connections are female NPT, per below chart.

Applications:

Any water, foam solution, or foam concentrate piping application that requires backflow prevention.

Specifications:

Check valves shall be Class 150S horizontal swing type with all bronze/brass construction for wetted parts. Valves are rated 150 PSI [10.3 BAR] saturated steam to 366°F [185°C] and 300 PSI [20.7 BAR] non-shock cold water, oil, or gas applications.

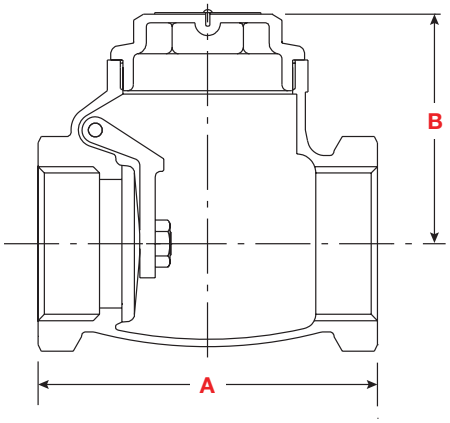
Technical Data:

Materials of Construction:

- ► **Body & Cap:** C83600 Cast Bronze.
- ► **Hinge & Disc:** C83600 Cast Bronze.
- ► **Hardware:** Brass.

Device Details:

- ► **Piping Connections:** All female NPT, per chart.
- ► **Maximum Operating Pressure Rating:** 300 PSI [20.7 BAR] Non-Shock WOG.
- ► **Weight:** Per chart.
- ► **Finish:** Brass.



Dimensional Data - US [Metric]				
Trident Check Valve	Size	A	B	Weight US Pounds Kilograms
Part Number	FNPT	Width	Height from Center of Port to Top	Lbs. [kG.]
30.063.0	1.5" [38.1mm]	4.25" [108mm]	2.87" [73mm]	3.2 Lbs. [1.4 kG.]
30.064.0	2.0" [50.8mm]	5.04" [128mm]	3.50" [89mm]	5.4 Lbs. [2.4 kG.]
30.065.0	2.5" [63.5mm]	6.30" [160mm]	4.25" [108mm]	11.5 Lbs. [5.2 kG.]
30.066.0	3.0" [76.2mm]	7.09" [180mm]	4.84" [123mm]	17.5 Lbs. [7.9 kG.]

Horizontal swing type check valves must be mounted in the horizontal position for proper operation.

Relief Valves #99.011.03

NFPA 20 requires that a safety relief valve to be installed on the discharge side of foam pumps as a mechanism to prevent system over-pressurization for protection of personnel and property. The relief valve must be sized to relieve 100% of the rated pump capacity at a pressure not exceeding 125% of the relief valve set pressure. Trident offers safety relief valves specifically designed for foam fire protection systems utilizing a positive displacement foam pump, and a relief valve is available for each size Trident GP Series Foam Pump offered.

All Trident safety relief valves are bronze and stainless steel construction, with operating set pressures available from 50 PSI [3.5 BAR] to 330 PSI [23 BAR]. The safety relief valve set pressure is typically set at 10% over the foam system designed operating pressure. Each valve is factory set and tested. The relief valve pressure adjusting mechanism is capped and secured with a seal wire to provide evidence of tampering.

UL® listed Trident GP Series Foam Pumps are provided with safety relief valves that have been inspected and tested by Underwriter's Laboratories under UL 448C.

Design Features:

- Automatic operation – no manual adjustment required.
- Pre-set operating pressure.
- All bronze, brass, and stainless steel construction with PTFE seals and EPDM seating.
- Suitable for all types of foam concentrates, including fluoroproteins and thixotropic types.
- Back pressure tight.

Applications:

Balanced pressure and direct injection foam firefighting systems.

Specifications:

The safety relief valve shall be assembled of bronze, brass, and stainless steel components with PTFE seals and EPDM seating, all compatible with any foam concentrate type. Valve inlet and outlet ports shall be of NPT connections, sized as shown on the following chart.

Relief valve design shall have the pressure spring mounted above the valve body away from full exposure to the foam concentrate.

Each safety relief valve shall be factory set and tested to a specific set pressure for the foam system designed operating pressure.

Technical Data:

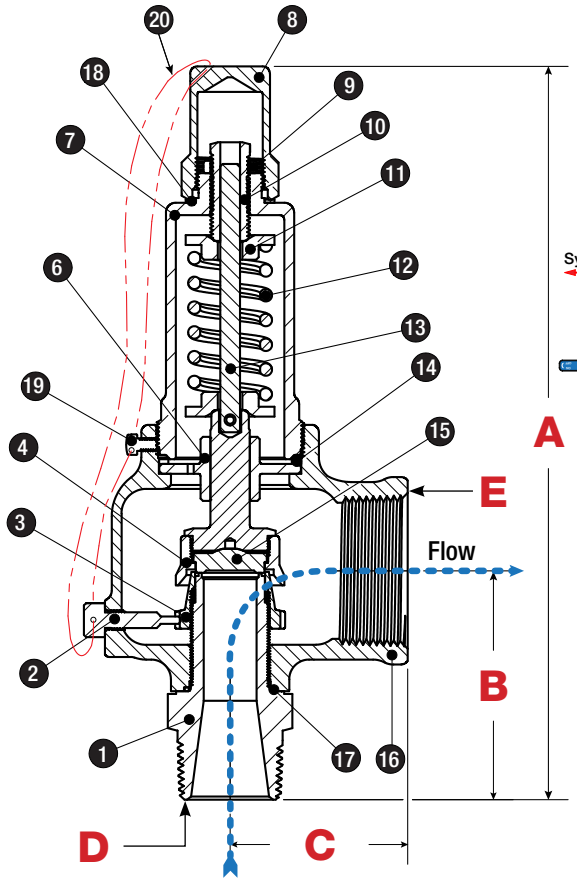
Materials of Construction:

- **Body:** C83600 Cast Bronze.
- **Nozzle:** 360 Alloy Brass.
- **Spring:** 17-7 Stainless Steel.
- **Hood & Cap:** 360 Alloy Brass.
- **Seating Material:** EPDM.

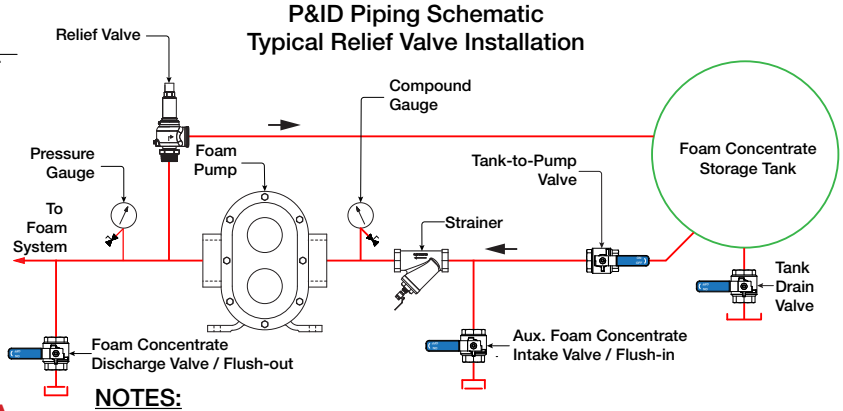
Device Details:

- **Pressure Set Range:** 50 - 330 PSI [3.5 – 23 BAR].
- **Hydrostatic Pressure Test:** 600 PSI [41 BAR].
- **Piping Connections:** All NPT, per chart.
- **Maximum Operating Temperature Rating:** 200°F [93°C].
- **Assembly Weight:** See Chart.
- **Finish:** Brass.

See Next Page For Details and Dimensions



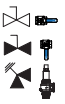
P&ID Piping Schematic
Typical Relief Valve Installation



NOTES:

1. Schematic Represents a Typical Relief Valve Installation into Foam System Piping. Final Design to be Determined by Foam System Engineer and Authority Having Jurisdiction (AHJ).
2. NFPA 20 Does Not Allow for a Shut-off Valve In The Relief Valve Discharge Piping Back To Tank.
3. Exact Valve Types and Stand-by Positions are to be Determined By Foam System Engineer and Authority Having Jurisdiction (AHJ).

Legend:



(5) Not Visible in This View
(21) Attached to Valve Body

Item	Description	Material
1	Nozzle	Brass
2	Lock Screw	Brass
3	Lower Ring	Stainless
4	Disc Holder	Brass
5	Disc Holder Shaft	Brass
6	Disc Guide	Brass
7	Bonnet	Brass/Bronze
8	Hood	Brass
9	Lock Nut	Brass
10	Pressure Screw	Brass
11	Spring Plate	Brass
12	Spring	Stainless
13	Spring Post	Brass
14	Disc Guide Washer	PTFE
15	Disc	Stainless
16	Body	Brass/Bronze
17	Nozzle Washer	PTFE
18	Gasket	PTFE
19	Lock Screw	Brass
20	Seal Wire	Braided Steel
21	Nameplate	Stainless

Dimensional Data - US [Metric]

Trident Relief Valve	A	B	C	D	E	Weight US Pounds Kilograms
Part Number	Height	Height to Center of Outlet	Width From Center of Inlet to Edge of Outlet	Male NPT Inlet Port	Female NPT Outlet Port	Lbs. [kG.]
30.071.0	7.38" [187.4mm]	2.38" [60.5mm]	1.63" [41.4mm]	3/4" [19.0mm]	3/4" [19.0mm]	2 Lbs. [0.9 kG.]
30.067.0	9.25" [235.0mm]	2.88" [73.2mm]	2.25" [57.2mm]	1-1/2" [38.1mm]	1-1/2" [38.1mm]	5 Lbs. [2.2 kG.]
30.067.1	10.25" [260.3mm]	3.38" [85.8mm]	2.63" [66.8mm]	1-1/2" [38.1mm]	2" [50.8mm]	9 Lbs. [4.0 kG.]
30.068.0	10.25" [260.3mm]	3.38" [85.8mm]	2.63" [66.8mm]	2" [50.8mm]	2" [50.8mm]	9 Lbs. [4.0 kG.]
30.067.2	11.75 [298.5mm]	3.50" [88.9mm]	2.88" [73.2mm]	1-1/2" [38.1mm]	2-1/2" [63.5mm]	16 Lbs. [7.3kG.]
30.068.2	14.25" [361.9mm]	4.0" [101.6mm]	3.25" [82.5mm]	2" [50.8mm]	3" [76.2mm]	24 Lbs. [10.8 kG.]

Contact Trident Emergency Products for Relief Valves used in UL® Listed foam pump applications for proper selection.

Relief Valve Selection Chart for **GP Series™** Foam Pumps

Min: 50 PSI [3.4 BAR] **Max:** 330 PSI [22.7 BAR]		Available Relief Valve Models and Sizes Based On Maximum Flow Rate at Specific Set Pressure Point											
Available Set Pressure Points		#30.071.0.xxx 3/4" x 3/4" [19.0 x 19.0]		#30.067.0.xxx 1-1/2" x 1-1/2" [38.1 x 38.1]		#30.067.1.xxx 1-1/2" x 2" [38.1 x 50.8]		#30.068.0.xxx 2" x 2" [50.8 x 50.8]		#30.067.2.xxx 1-1/2" x 2-1/2" [38.1 x 63.5]		#30.068.2.xxx 2" x 3" [50.8 x 76.2]	
PSI	BAR	GPM	LPM	GPM	LPM	GPM	LPM	GPM	LPM	GPM	LPM	GPM	LPM
50	3.4	25	94.6	66	249.8	123	465.6	123	465.6	206	779.8	316	1196.2
55	3.8	29	109.8	68	257.4	129	488.3	129	488.3	216	817.6	331	1253.0
60	4.1	31	117.3	72	272.5	135	511.0	135	511.0	225	851.7	346	1309.8
65	4.5	32	121.1	75	283.9	141	533.7	141	533.7	234	885.8	360	1362.7
70	4.8	33	124.9	79	299.0	146	552.7	146	552.7	243	919.9	374	1415.7
75	5.2	34	128.7	82	310.4	151	571.6	151	571.6	252	953.9	387	1465.0
80	5.5	35	132.5	86	325.5	156	590.5	156	590.5	260	984.2	400	1514.2
85	5.9	37	140.1	90	340.7	161	609.5	161	609.5	268	1014.5	412	1559.6
90	6.2	38	143.8	93	352.0	166	628.4	166	628.4	276	1044.8	424	1605.0
95	6.6	39	147.6	96	363.4	170	643.5	170	643.5	283	1071.3	435	1646.7
100	6.9	40	151.4	99	374.8	175	662.4	175	662.4	291	1101.6	447	1692.1
125	8.6	44	166.6	110	416.4	195	738.2	195	738.2	325	1230.3	499	1888.9
150	10.3	48	181.7	121	458.0	214	810.1	214	810.1	356	1347.6	547	2070.6
175	12.1	52	196.8	132	499.7	231	874.4	231	874.4	385	1457.4	591	2237.2
200	13.8	56	212.0	142	537.5	247	935.0	247	935.0	411	1555.8	632	2392.4
225	15.5	59	223.3	150	567.8	262	991.8	262	991.8	436	1650.4	670	2536.2
250	17.2	63	238.5	158	598.1	276	1044.8	276	1044.8	460	1741.3	706	2672.5
275	19.0	66	249.8	167	632.2	290	1097.8	290	1097.8	482	1824.6	741	2805.0
300	20.7	69	261.2	172	651.1	302	1143.2	302	1143.2	504	1907.8	774	2929.9
330	22.8	72	272.5	180	681.4	320	1211.3	320	1211.3	524	1983.6	805	3047.3

Use Trident Performance Curves to Determine Pump Flow (GPM) at Required Operating Pressure (PSI) and Speed (RPM).

Selection Instructions for **Fixed Systems**

1. Determine final foam pump flow based on model selection, required system operating pressure and driver speed.
2. Select relief valve set pressure point by adding 10% to the system operating pressure and rounding up to the next set pressure point in the chart above.
3. Select relief valve size/part number based on foam pump flow and required set pressure point. Required relief valve flow cannot be less than flow shown on chart for specific model and set pressure point selected. **Example**: A foam system requiring 130 GPM [492 LPM] foam concentrate flow at 200 PSI [13.8 BAR] would require a pump to flow a minimum of 150 GPM [567 LPM] (15% extra) and a relief valve with a set pressure point of 225 PSI [15.5 BAR]. The **minimum** relief valve selection would be #30.067.0.225. **However** this may change based on actual pump driver speed and foam pump flow.

NOTE: Relief valve Part Numbers shown above in RED are to be used in applications requiring UL® Listing.

Selection Instructions for **Mobile Apparatus**

1. As foam pump flow and pressure ranges vary on mobile apparatus, the best approach is to size the valve for the worst case condition. **Example**: A GP300 operating at 1800 RPM @ 250 PSI [17.2 BAR] will flow approximately 310 GPM [1173 LPM]. Relief valve set pressure point for this operating pressure should be 275 PSI [19.0 BAR]. Valve selection would be #30.067.2.275.

⚠ WARNING Relief Valves are a Pressure Safety Device designed to protect personnel and equipment - proper relief valve selection is important. Per NFPA 20, Do Not install a shut-off valve between the pump and the relief valve or the relief valve and the storage tank. Contact Trident Emergency Products with any questions regarding proper selection or installation of a relief valve. **SAFETY FIRST.**

Foam Pump Ordering Guide

Thank you for considering Trident for your Foam Pump needs.
If you have any questions regarding this ordering process please contact Steve Tolbert via email at: stolbert@tridentdirect.com

Company Name: Date:

Contact Name:

Phone Number:

Email Address:

Step 1 Select GP Series™ Pump Model Series – Refer to the Performance Curves for the capacity of each model.

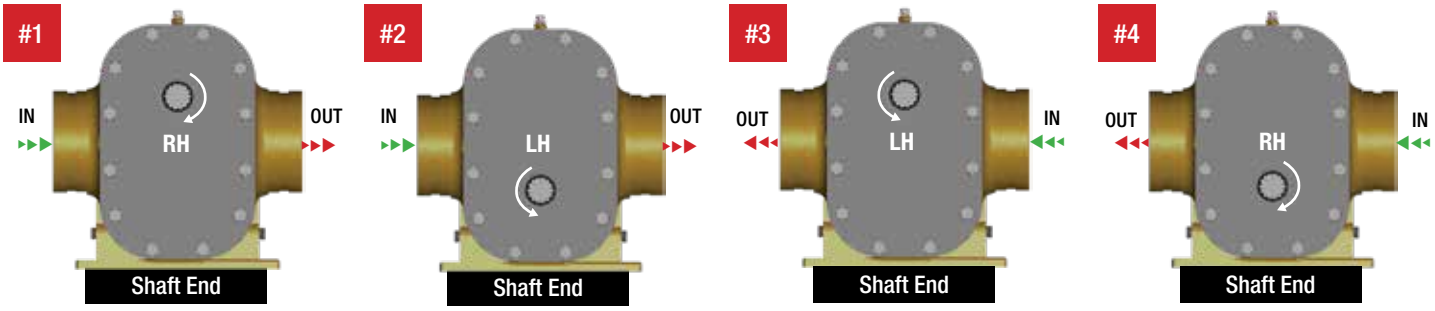
GP30	Nominal Flow:	30 GPM	[115 LPM]	Maximum Operating Pressure:	300 PSI	[20.7 BAR]
GP60	Nominal Flow:	60 GPM	[225 LPM]	Maximum Operating Pressure:	300 PSI	[20.7 BAR]
GP120	Nominal Flow:	120 GPM	[455 LPM]	Maximum Operating Pressure:	300 PSI	[20.7 BAR]
GP160	Nominal Flow:	160 GPM	[606 LPM]	Maximum Operating Pressure:	300 PSI	[20.7 BAR]
GP200	Nominal Flow:	200 GPM	[760 LPM]	Maximum Operating Pressure:	300 PSI	[20.7 BAR]
GP300	Nominal Flow:	300 GPM	[1135 LPM]	Maximum Operating Pressure:	300 PSI	[20.7 BAR]
GP350	Nominal Flow:	300 GPM	[1135 LPM]	Maximum Operating Pressure:	300 PSI	[20.7 BAR]
GP500	Nominal Flow:	500 GPM	[1893 LPM]	Maximum Operating Pressure:	300 PSI	[20.7 BAR]

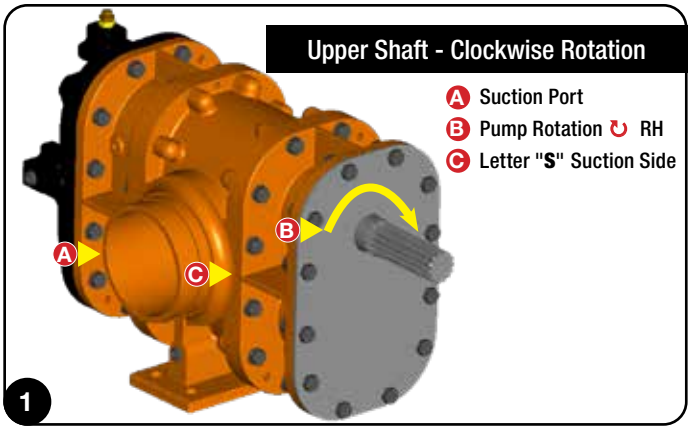
Step 2 Does Pump Require a UL® Listing? This only applies to the GP30 | GP60 | GP120 | GP160 | GP200 Models.

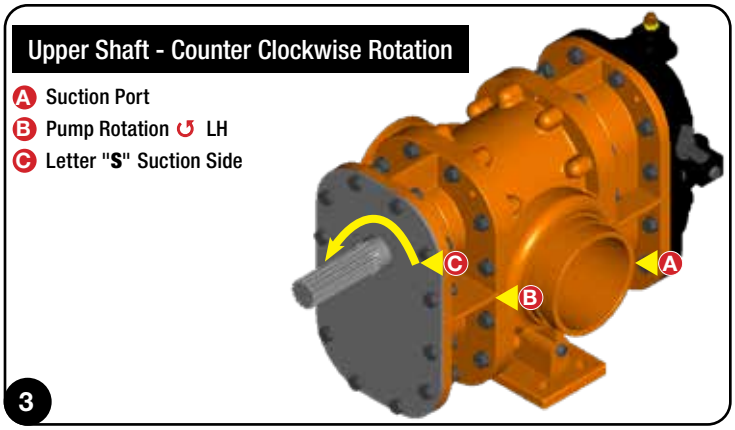
Yes No

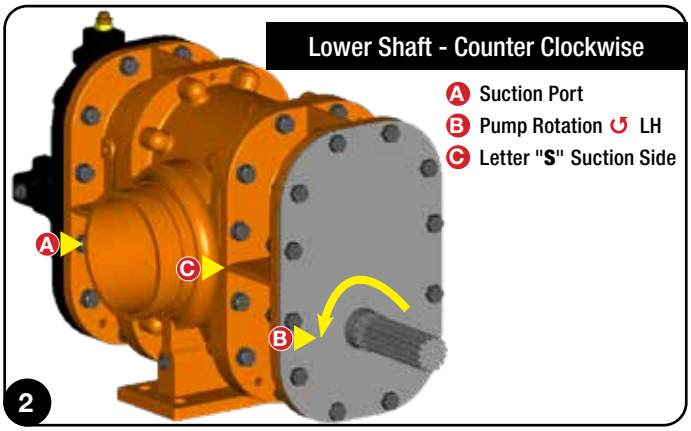
Step 3 Select Drive Position and Rotation Direction. Refer to images below.

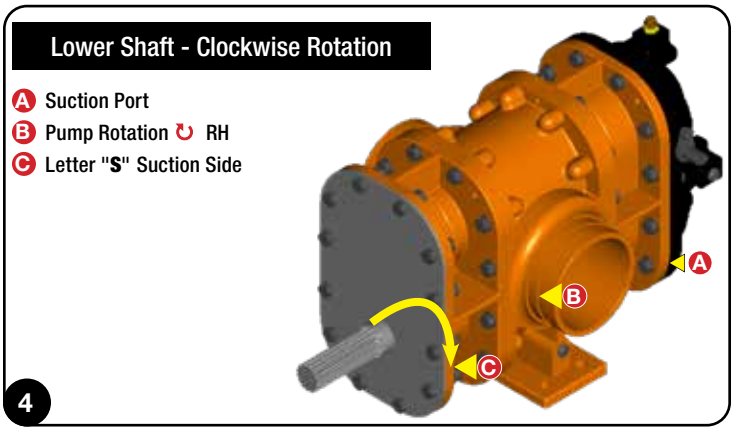
#1	Top (Upper) Shaft Position	Right Hand (Clockwise) Rotation
#2	Bottom (Lower) Shaft Position	Left Hand (Counter Clockwise) Rotation
#3	Top (Upper) Shaft Position	Left Hand (Counter Clockwise) Rotation
#4	Bottom (Lower) Shaft Position	Right Hand (Clockwise) Rotation











Step 4 Select GP Series™ Pump Power Source.

Model U	Universal: PTO, Electric Motor, Gas/Diesel Engine, Water Powered Motor
Model H	Hydraulic: Hydraulic Motor Drive, Cast Iron Mounting Bracket Provided
Model M	Direct Engine Drive, Cast Iron Mounting Bracket Provided

Model U: Universal Drive

Model H: Hydraulically Driven

Model M: Engine Driven

Step 5 Relief Valve Supplied by Trident: Yes No

Relief Valve Selection Will be Based on The Following Required Information:

- Maximum Foam System Operating Pressure:
  (Relief Valve Set Pressure will be 10% over System Operating Pressure).
- Maximum Foam Pump Operating Speed (RPM):
- Trident will select the valve based on the above information and provide model information and data sheet.
- UL® Listed pumps will automatically be supplied with properly sized relief valve based on provided foam system data.

Ball Valves #99.011.5

Manually operated, nickel plated brass ball valve in full port configuration with chrome plated ball. Valves are provided with PTFE seat and stem packing, with female NPT threaded piping connections. Manual operation lever provided with full closed to full open in 90° (quarter turn).

Design Features:

- All wetted parts are nickel and chrome plated brass.
- Full port configuration.
- Suitable for all types of foam concentrates, including fluoroproteins and thixotropic types.
- Valve body connections are female NPT, per below chart.
- PTFE seat and stem packing.

Applications:

Any water, foam solution, or foam concentrate piping application.

Specifications:

Ball valve shall be full port configuration with all bronze/brass construction for wetted parts. Valves are rated to an operating pressure of 600 PSI [41.3 BAR] CWP, non-shock and vacuum service to 29" Hg. Ball valve shall be equipped with a PTFE seat and stem packing.

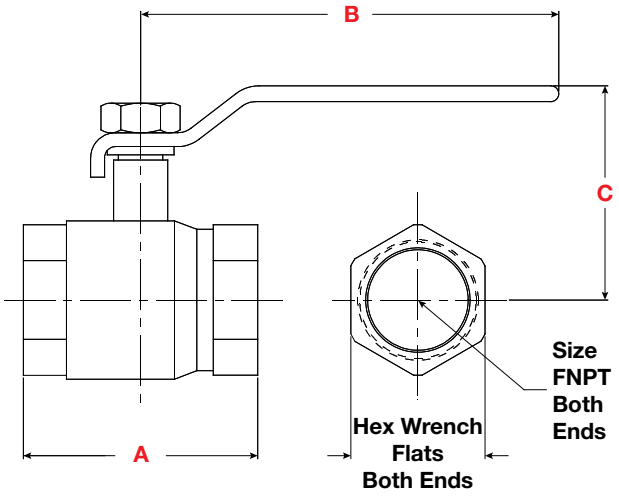
Technical Data:

Materials of Construction:

- **BODY:** Nickel Plated Brass.
- **BALL:** Chrome Plated Brass.
- **SEAT and STEM PACKING:** PTFE.
- **STEM:** Brass.
- **HANDLE:** Plated Steel with Rubber Cover.

Device Details:

- **Piping connections:** All female NPT, per chart.
- **Maximum Operating** Pressure Rating: 600 PSI [41.3 BAR].
- **Maximum Vacuum Service:** 29" Hg.
- **Weight:** Per chart.
- **Finish:** Nickel Plated Brass.



Dimensional Data - US [Metric]						
Trident Ball Valve	Size	A	B	C	Hex Wrench Flats	Weight US Pounds Kilograms
Part Number	FNPT Inch	Width	Handle Length from Center Shaft	Handle Height from Center of Valve	Inches [mm]	Lbs. [kG.]
30.056.0	1.0" [25.4mm]	2.56" [65.0mm]	4.57" [116.0mm]	2.34" [59.4mm]	1.47" [37.3mm]	1.0 Lbs. [0.5 kG.]
30.057.0	1.5" [38.1mm]	3.50" [88.9mm]	5.71" [145.0mm]	3.01" [76.4mm]	2.09" [53.0mm]	2.0 Lbs. [0.9 kG.]
30.058.0	2.0" [50.8mm]	4.09" [103.9mm]	5.71" [145.0mm]	3.31" [84.0mm]	2.55" [64.7mm]	3.0 Lbs. [1.3 kG.]
30.059.0	2.5" [63.5mm]	5.28" [134.1mm]	9.41" [239.0mm]	4.37" [110.9mm]	3.19" [81.0mm]	6.0 Lbs. [2.7 kG.]
30.060.0	3.0" [76.2mm]	6.00" [152.4mm]	9.41" [239.0mm]	5.04" [128.0mm]	3.78" [96.0mm]	8.0 Lbs. [3.6 kG.]
30.061.0	4.0" [101.6mm]	6.89" [175.0mm]	10.63" [270.0mm]	5.20" [132.0mm]	4.81" [122.1mm]	10.0 Lbs. [4.5 kG.]

Warranty Information

Foam Pump Warranty

Trident Emergency Products (Seller) warrants its GP Series rotary gear foam pumps to be free of defects in materials and workmanship under normal use and service for which the products were designed to the Buyer. This warranty is for a period of 60-months after shipment from factory. Seller must be notified in writing within the warranty period of any defects and shall have the option of requiring the return of parts or entire pump to its factory for verification of any claim. Seller will have the sole discretion in determining whether a pump is defective, and to make determination to repair or replace said pump during the warranty period. Attempt by Buyer or End User to make alterations or repairs to a pump during the warranty period without written consent by Seller will void the warranty.

The use of non-Trident specific parts to make repairs without written concent by the Seller will void the warranty.

THIS WARRANTY IS THE SOLE WARRANTY OF SELLER AND SELLER HEREBY EXPRESSLY DISCLAIMS AND BUYER WAIVES ALL OTHER WARRANTIES EXPRESSED, IMPLIED IN LAW OR IMPLIED IN FACT, INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Seller's sole obligation under this warranty shall be, at its option, to repair or replace any equipment (or its component parts) which has a defect covered by this warranty, or to refund the purchase price of such equipment or part. Under the terms of this warranty, Seller shall not be liable for **(a)** consequential, collateral, special or liquidated losses or damages; **(b)** equipment conditions caused by normal wear and tear, abnormal conditions of use, accident, neglect, or misuse of said equipment; **(c)** the expense of, and loss or damage caused by, repairs or alterations made by anyone other than the Seller; **(d)** damage caused by abrasive materials, chemicals, scale deposits, corrosion, mishandling, or other similar conditions; **(e)** any loss, damage, or expense relating to or resulting from installation, removal or reinstallation of equipment; **(f)** any labor costs or charges incurred in repairing or replacing defective equipment or parts, including the cost of reinstalling parts that are repaired or replaced by Seller; **(g)** any expense of shipment of equipment or repaired or replacement parts; or **(h)** any other loss, damage or expense of any nature.

The warranty shall not apply to any additional Trident supplied equipment, or Buyer/End User supplied equipment, associated with pump operation that is covered by another manufacturer's separate or special warranty, such as motors, engines, couplings, relief valves, pump control panels, etc. Pump defects caused by improper installation and plumbing connections, failure to follow installer responsibilities and periodic pump inspection and maintenance outlined in the O&M Manual, and operating the pump outside of the intended parameters established by the Seller will void the warranty. The failure to provide proper discharge over-pressure protection in the form of a relief valve or other device or system will void the warranty.

PERFORMANCE: Equipment performance outlined on submitted curves is based on water as a medium. Performance may vary based on actual medium pumped and power applied.

LIABILITY LIMITATIONS: Under no circumstances shall the Seller have any liability under the Order or otherwise for liquidated damages or for collateral, consequential or special damages or for loss of profits, or for actual losses or for loss of production or progress of construction, regardless of the cause of such damages or losses. In any event, Seller's aggregate total liability under the Order or otherwise shall not exceed the contract price.

MODELS COVERED: This warranty covers the following models: GP30, GP60, GP120, GP160, GP200, GP300, GP350 and GP500.

DOCUMENT #99.013.6 · EFFECTIVE DATE May 22, 2019

FOAM PRODUCTS

FOAMATE™

ATP Systems - Around The Pump Proportioners

Class A Proportioner

LPM Version P/N: 31.008.1
GPM Version P/N: 31.008.0

Class B Proportioner

LPM Version P/N: 31.014.3 VIC, 31.014.03 THREADED
GPM Version P/N: 31.014.2 VIC, 31.014.12 THREADED

Foam Concentrate **Transfer Cart**

TRIDENT GP SERIES™ PORTABLE FOAM TRANSFER PUMP FTP™

Transfer Cart #31.027.0 with #27.021.0 Camlock Piping Connections.

Other piping connections available upon request.

Contact Us For Details On These And Other Foam System Products

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215-293-0700 **Phone**
215-293-0701 **Fax**
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World Class Fire Industry Products

June 23, 2020
Trident Emergency Products, LLC