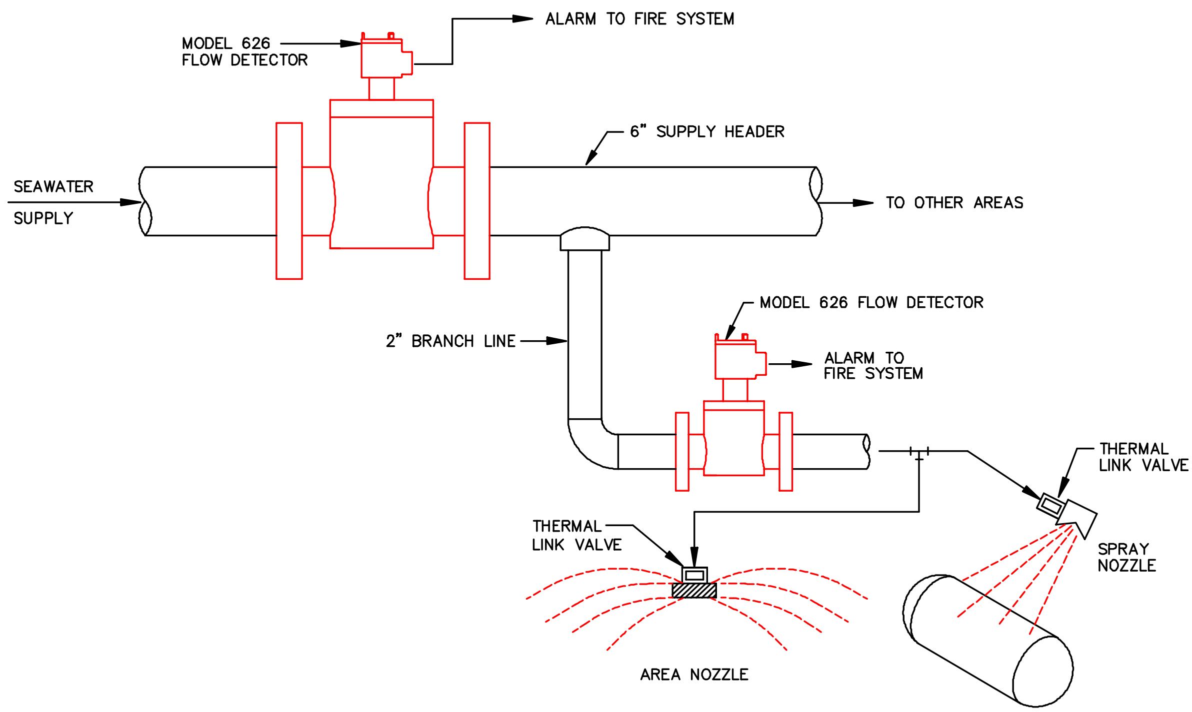
THE 10 ATTRIBUTES OF OFFSHORE FIREWATER FLOW DETECTORS

- Must reliably detect the low flow volume caused by a single discharging nozzle
- Must not restrict nor disrupt the firewater flow stream
- Must not be damaged by high flow rates
- Must not be internally corroded by seawater
- Must not fail to operate because of buildup and seawater deposit fouling
- Must not be externally damaged by salt spray, waves, rough handling, etc.
- Must not require external power to detect flow nor to operate its switch
- Must be easy to flow test and prove out
- Must have a long history of reliable offshore firewater service
- Must perform flawlessly during the lifetime of the facility

TYPICAL FIREWATER FLOW DETECTION PIPING



FIREWATER FLOW DETECTOR/SWITCH DESIGN

Offshore oil platforms, as well as some ships and barges, commonly use automatic deluge type fire suppression systems. Seawater is usually the preferred suppressant for large systems. The use of seawater poses some significant challenges for the header and branch flow detecting devices. Conventional “flow switches” cannot meet all of the required criteria for a variety of reasons. A short analysis of why common types of flow sensing devices do not work follows.

Conventional Electronic Flow Switches and Meters

There are many electronic instrument techniques for measuring liquid flow rates. Electronic flow devices are complicated when compared to a simple mechanical target type. The level of long-term reliability of a mechanical switch is an order of magnitude better than an electronic flow device. The following points illustrate why this is true.

- Electronic flow switches are inferential devices. That is, they measure something that happens when flow occurs. Examples include thermal loss, changes in Doppler frequencies, etc. Inferential type electronic flow switches have many more parts, are inherently more complicated, and therefore less reliable than a simple target type mechanical flow switch with very few parts. A target type switch is directly actuated by seawater flow pushing on the target; is simple but reliable.
- An electronic flow switch can fail in hundreds of different ways. A properly designed mechanical one can only fail in few ways, all of which are predictable.
- The multiple transistors in an electronic microchip commonly age and fail in time. Such a failure might leave the output relay in either the “normal” or the “alarm” condition. Unfortunately, this unknown condition makes it nearly impossible to predict or force a failure position of the output relay contacts. They might fail in the “normal” or, just as easily, fail in the “alarm” condition. An electronic unit must be tested every few seconds to verify that it is operating properly and is safely monitoring the firewater flow rate. Unfortunately, the “test” device must also be electronic. This requires that something be done to “test” the “test device”. The only practical alternative solution (insurable risk) is to put in 3 separate flow devices and hook them up in a “voting mode”. The assumption is made that whatever answer that two out of the three give is correct. This solution is complicated and expensive. The 3 devices and their monitor also require considerable maintenance and frequent calibrations.
- Electronic devices are sensitive to lightning strikes and voltage surges, which can cause them to fail in random ways. They can also fail to operate when the supply voltage is low.
- Electronic flow devices cannot monitor firewater flow when facility supply power is off. Generally, they are set up to go to the “alarm” mode on loss of power. Most platform facilities do not need additional false alarms every time the power dips or goes off. Also, the possibility of fire must be continuously monitored, especially when the power is off.
- Electronic flow switch circuitry tends to be susceptible to corrosion failure in wet salty environments such as are found on an offshore facility.
- There is no known history of satisfactory service being obtained through the use of electronic flow devices to monitor offshore firewater flow.

Conventional Inserted or In-Line Mechanical Type Target Flow Switches

These detectors rely on an obstruction ("target") placed in the pipeline. The obstruction produces a force due to the resulting pressure drop when the flow rate starts. This force is used to actuate an output switch. The size of this obstruction must be large in firewater systems so that the low flow volume, due a single nozzle, can be reliably detected in 2", 3", 4", or 6" size firewater flow piping. The seawater flow increases substantially as more nozzles begin to operate. The resulting high flow volume results in an unacceptably high-pressure drop across the necessarily large obstructing "target". This causes either too little seawater to flow or the "target" to be torn off and carried down the line, possibly plugging off flow to some nozzles.

Other reasons that common target type flow switches fail to be suitable are:

- A rod or arm, extending up into an anular cavity, holds the "target" in place. This cavity recess collects deposits over time and can prevent the "target" from moving and the detector from operating.
- Many designs use a thin metal bellows or corrugated diaphragm as a pressure containing seal between the electrical switch housing and the flow line containing the target. Corrosion of these thin members is commonly the cause of early failure of these devices.
- Some designs use "O" ring seals and sliding parts to operate the output switch. Deposits and surface corrosion work together to prevent operation of the switch contacts.
- High seawater flow rates occur during periodic testing of the fire system as well as during fires. "Targets" which remain in the flow path are essentially bluff bodies and generate very strong Von Karmen vortices during high flow velocity events. The load due to the high flow rate, added to the twisting action caused by the vortices, can easily break the target/arm assembly off and send it downstream. Most damaged conventional designs then fail to alarm because they revert to the "safe" position when the target/arm comes off. Their switch contacts deactivate, usually resulting in a resetting of the alarm system to the normal "safe" position. This causes the central alarm system to fail to respond to the fire.

Reliable Nonobstructing Low Flow Rate Detector

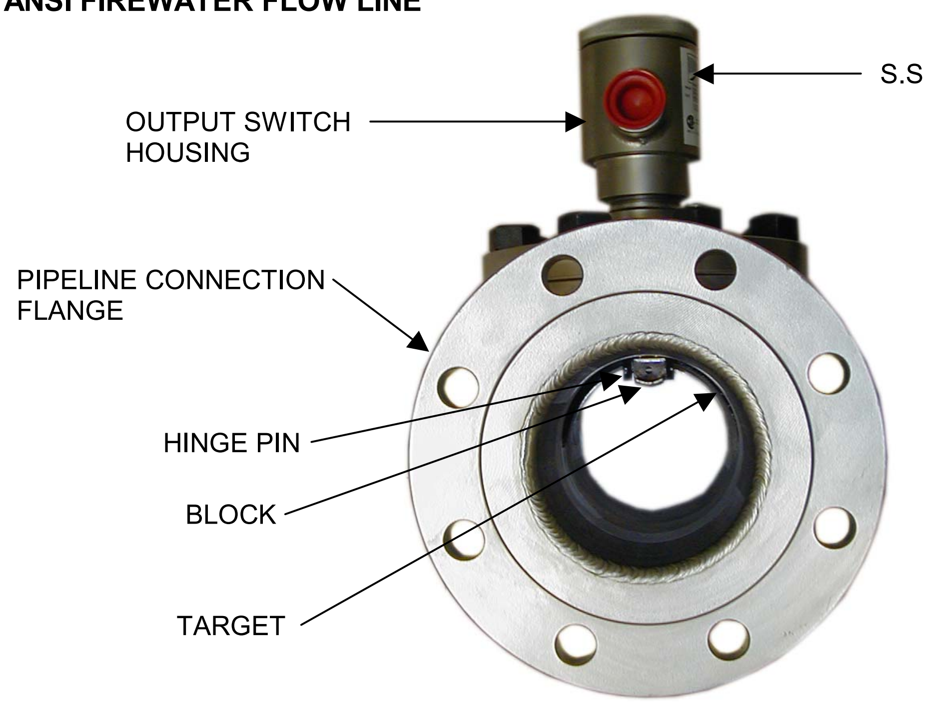
The Delta Controls Model 626 flow detector has been designed for and is built to detect flow in seawater deluge fire protection systems. It incorporates all of the attributes essential to correctly detecting flow in such seawater systems. The design and construction techniques used on the Model 626 have been developed to suit the needs of this demanding service.

- A nearly line size obstructing target hangs down into the pipeline bore. The relatively low flow volumes due to a single discharging nozzle are enough to cause the target to actuate the output alarm switch and then to rotate on its hinge.

- The target is hinged at the top which allows it to rotate upwards until it is flush against the inside pipe wall. The pipe bore is left fully open and unrestricted until the seawater flow stops. Gravity then pulls the target back into its down position and resets the output switch contacts to the normal position. The Model 626 again quiescently monitors the seawater flow rate; awaiting the next event.
- High flow velocities do not damage the Model 626. Only the thin edge of the target is exposed to the seawater flow. The hinge pin and target easily withstand the force caused by the designed high volume flow rate.
- The flow detector is made from non-corroding materials such as Monel 400,
- Alloy 20, and Hastelloy "C".
- The "cupped" target is "fitted" and does not rub on the inside of the body or the pipeline. The offset top mounted target hinge cannot prevent the target from rotating. The torque available from full line pressure (foot-pounds) is available to force the target to rotate. Buildup, deposits, etc will be pushed out of the way and the switch contact will change to the "alarm" position.
- Most of the Model 626 exposed exterior surfaces are made from the same materials as the internal parts and are suitable for a wet, salty environment. The output switch housing is made from Stainless Steel. It easily withstands saltwater spray and waves. Gold switch contacts and gold plated terminal blocks are available for added protection when needed for extreme conditions.
- The force of gravity and the force stored in the field of a permanent magnet provides a "set point" force. The force due to the flow of seawater provides all the power needed to operate the flow detector switching contacts. There is also a load spring inside the switch housing, which pushes on the output switch. It acts as a bias force, ensuring that the output switch contacts goes to a known position.
- Testing is easy and reliable. A simple way is to open a down stream discharge flow orifice equivalent to one nozzle (or other selected flow volume) and witnessing operation of the Model 626 flow detector. Maximum available system flow can be tested without damage to the flow detector or its target.
- Over 15 years of reliable field service have verified that the design, attention to detail, and fabrication techniques used on the Model 626 are right for the job.
- No failure, suspicious actions (or inactions), of the Model 626 have been noted nor reported.

ALL MONEL WETTED 3”/150# MODEL 626 FOR USE IN A 3” ANSI FIREWATER FLOW LINE

ALL 316L S.S. 2”/300# MODEL 626 FOR USE IN A 2” ANSI BRANCH FIREWATER FLOW LINE



MODEL 626 FIREWATER FLOWSWITCH SHOWN WITH ITS TARGET ROTATED UP INTO THE “ALARM” POSITION
FULL OPEN BORE – NON-RESTRICTING

DELTA CONTROLS Corporation
Engineered Sensors – For Difficult Services
585 Fortson Street Shreveport, La. 71107
Voice: (318) 424-8471 Fax: (318) 425-2421
Email: delta@deltacnt.com Web: www.deltacnt.com

AN-62601 EEB 10 AUG 04
The most recent version of this document is available at www.deltacnt.com/AN-62201.pdf