



REPORT ON THE USE OF FLOW METERS IN THE FIRE & RESCUE SERVICE

INTRODUCTION

Since 2001 Laois County Fire & Rescue Service has been fitting flow meters to all its pumping appliances.

Greater Manchester Fire & Rescue Service has been using flow meters for a considerable number of years and had released much material about them. In particular there are several health & safety benefits in using flow meters and efficiencies in fuel consumption. Research was carried out by Laois County Fire & Rescue Service and based on the findings it was decided to fit flow meters to one pumping appliance in 2001.

To date 4 pumping appliance plus 1 water tanker have flow meters fitted to all delivery outlets. All flow meters fitted are TSi flow meters which are manufactured in Portlaoise, Co. Laois & distributed worldwide.

METHODS FOR DELIVERING WATER ON THE FIREGROUND.

There are two methods of delivering water from a fire appliance, by either the pressure method or the flow method.

Pressure method

This method of delivering water is based on recommended branch pressures, matching branch sizes to optimum branch pressures based on standard calculations in the Fire Service Manual. Pressure losses due to head and friction have to be calculated by the pump operator in order to set the correct pump pressure in order to deliver the correct pressure at the branch.

There are several disadvantages in using pressure as the method of delivering water.

1. The pump operator needs to know the size of branch in use and its associated optimum operating pressure, how many lengths of hose are in each line, the type of hose, the pressure loss due to friction for each length of hose and pressure loss/gain due to head. Using all this information he then has to calculate the required pump pressure.
2. Because the pump can only be set at one pressure, only branches of the same size should be used e.g. 2 x 12.5 mm. It is not ideal using

this method to use branches of different sizes as the optimum pressures (& therefore flows) vary depending on branch size.

3. Larger size branches require higher pressures, which leads to higher rpm of the pump, leading to increased noise, increased fuel consumption and finally greater wear and tear on the pump impeller.
4. If one branch is shut down suddenly, there is resulting increase in the pump pressure and the jet reaction on the open branch, which could result in the fire-fighter on the end of the branch being injured if he/she is unable to control the increased jet reaction. This increased jet reaction could have significant dangers for fire-fighters working aloft and requires a very vigilant pump operator to monitor pump pressure.
5. Similarly when an additional branch is put to work there is an initial pressure drop, until the pump operator increases the pressure, which could lead to a loss or a lack of water in the previously working branch, again with potential health & safety consequences.

Flow method.

This method of delivering water is based on the flow at the end of the branch. As flow is independent of length, the flow going through the flow meter will be the same as that going through the tip of the branch.

Once the pump operator knows the optimum flow for each size branch he/she opens the delivery until this flow rate is achieved. A list of optimum flows is recorded on a chart fixed in the pump bay, an example of which is shown at table 1. (Taken from Manual of Firemanship, Book 7, "Hydraulics & water supplies" table 3, page 69)

<u>BRANCH SIZE</u>	<u>FLOW RATE</u>
3/8 " (9 mm) AWG type	75 lpm
1/2 " (12.5 mm)	160 lpm
5/8 " (15 mm)	280 lpm
3/4 " (20 mm)	600 lpm
1 " (25 mm)	1100 lpm
Marauder type	As stated on branch

Table 1

The method of using the flow meters to deliver the correct flows is as follows:-

Set the pump pressure to 2000 rpm. With the modern World Series Pumps noise levels at 2000 rpm enable normal conversation to take place at the pump bay.

Identify the size of branch on each line of delivery hose and then open the delivery valve until the correct flow is displayed on the flow meter. There is no

need to open the delivery valve any further. Monitor and adjust the flows on the other working branches as necessary, but only minimal variations will be required.

With modern branches which have fixed flow rates e.g. Akron Assault, opening the delivery valve fully is not an issue, but with other types of branch, either straight through uncontrolled or the controlled branch e.g. AWG, opening the delivery valve beyond the optimum flow rate may give too much pressure on the branch, possibly resulting in the break up of the water stream & increased jet reaction with potential injury.

There are several advantages in using flow rates over pressures as the method of delivering water.

1. Once the pump operator knows the size of the branch in use all he/she needs to do is open the delivery valve until the correct flow is showing. There is no need to know the size of branch in use and its associated optimum operating pressure, how many lengths of hose are in each line, the type of hose, the pressure loss due to friction for each length of hose and pressure loss/gain due to head. No fire ground hydraulic calculations are required.
2. An infinite number of branch sizes can be used with output on each branch pre-determined by standard optimum flows for each size branch. In training branches ranging from 12.5 mm up to large ground monitors were used without having to increase pump rpm.
3. Larger size branches do not require an increase in pump pressure as the pump operator simply opens the delivery to the rated output of the branch. There is no increase in pump rpm & consequently no increased noise.
4. There is no increase in jet reaction on a branch if one branch is shut down suddenly as the flow to the working branch has not changed. This is particularly beneficial if fire-fighters are working aloft.
5. The pump operator is immediately aware if a branch is shut down as the flow meter will read zero.
6. The flow meter default setting is flow in either litres or gallons per minute. However they can be changed to cumulative flow by pushing a button on the flow meter, which is useful if the total quantities of water delivered are required e.g. charging for quantities of water used.

TRAINING

Initial training was provided by Mr. Tim Carew of TSi Flow Meters, the manufacturer and supplier of the flow meters. Ongoing training in the use of flow meters is provided by Laois County Fire & Rescue Service personnel.

HEALTH & SAFETY

As previously stated the major advantages of using flow meters are the reduction in noise levels and no increased jet reaction when branches are shut down.

SUMMARY

Flow meters should be fitted to all delivery outlets.

Significant health & safety benefits are derived from the use of flow meters.

Fuel consumption is reduced.

There is less wear & tear on the pump.

Training in the use of flow meters is simple & straight forward.

There is no need for the pump operator to carry out hydraulic calculations.

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