Admixture Dispensing (with Flowmeters) Discharge Line Locations and Sequencing for Concrete Batching Operations

Cement hydration is a chemical reaction that begins when water is added to the concrete mix. Adding chemical admixtures to the concrete mix alters the chemical reaction in subtle and sometimes complex ways. Admixtures can affect cement hydration depending upon:

i). The discharge location in the batch plant,

ii). The point in time in the batch cycle (sequencing) at which they are discharged.

One worthy reference on the cement hydration process that also includes information on the use of admixtures is "Design and Control of Concrete Mixtures" by the Portland Cement Association.

ManuFlo dispensing equipment is used to measure and safely add admixtures into the concrete mix during the batching / mixing cycle. This Technical Guide gives recommendations on admixture discharge line location and sequencing that should provide for the optimum performance of the admixtures. These recommendations should be followed for all new dispenser installations. For existing dispenser installations that do not meet these recommendations, there is no need to necessarily change anything unless a concrete or admixture performance issue is experienced. If that does occur, a change in admixture sequencing should be considered first.

Three general rules of should be followed:

1.
Different chemical admixtures should not come in physical contact with one another. When certain admixtures come in contact with each other, a chemical reaction may take place that will lessen or negate their performance capabilities. Physical contact can take place at the end of admixture discharge lines, in a water-holding tank, in a mixing hopper (WOK), injected in water-discharge pipe, or when fed directly into the rear of the concrete mixing truck at the SOK (chute). Of particular importance, the following should be avoided:
A. Air Entraining Agents (AEA) in contact with any set accelerators, and all products containing calcium chloride,
B. AEA in contact with hot water (usually greater than 60°C (ACI 306)), and
C. Products containing calcium nitrite in contact with water reducers and/or mid-range water reducer products.

2.
In some cases Individual admixtures should be added at different times (known as sequencing) during the batching operation in order to allow optimum performance.

3.
Continuous testing by the concrete producer is recommended. If concrete testing or prior experience by the concrete producer has taken place before dispenser installation and has shown that different admixture discharge line location or sequencing performs better than the requirements listed below, then these requirements may be modified after discussion with your admixture supplier. Since all cements and other concrete-making materials differ from source to source, and can vary over time, continuous testing by the concrete producer is recommended for optimum admixture performance, especially when materials, admixture discharge location or sequencing change.

Liquid Admixture Discharge Line Locations

General recommended dispensing discharge line locations options. As a general practice, the selected admixture volumes should be batched within the batched water delivery volume time cycle to thoroughly mix. (Note: The most efficient means is the water be measured by magnetic flowmeters).

1/ Plant Water-Discharge Pipe (WOK)— Install individual admixture discharge lines to feed into the mixing pan (WOK) next to the plant water discharge line so that the admix mixes well with the water and the dry solids. Make sure the admix discharge pipes will not be hit/damaged by the dry ingredients dropping into the WOK.

2/ Directly Into the Truck Mixer loading point (SOK) – When discharging directly into the truck mixer barrel (over time), care must be taken to reduce the opportunity for the discharge lines to clog due to cement dust, damage from dry solid ingredients dropping from above, or coagulation or encrustation of admixture at the pipe line discharge point due to admix being in prolonged contact with air. If flowrates diminish, ensure that the discharge hose pipe outlets are clear, inspect and clean as required. (The same may apply to the WOK app.).

3/ Water-Holding Tank (WHT) — With this method the admixture lines feed directly into the overhead water holding (hopper) tank. The admixtures are mixed in with the water and the water is then discharged.

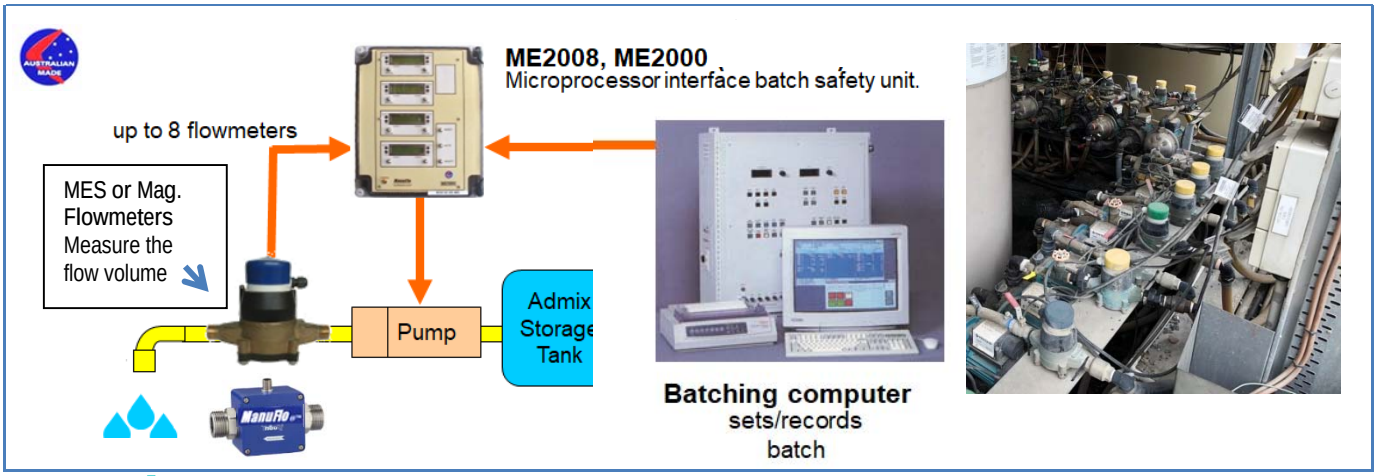
4/ Injected into Water delivery line (IWD) – Admixture lines can be plumbed directly into the water delivery line. Warning: Must use pneumatic solenoid valves at end of line near injection point to avoid syphoning issues. Again the set admixture volumes must be batched within the set batched volume water delivery time cycle.

NOTE:
For points 1-4 typically the MES20 20mm will have the flowrate capacity (65LPM) to deliver the desired speed within the water batch time cycle. But in some cases where the water is delivered very fast by 100mm diameter or larger pipelines (thus the time cycle much shorter), then the larger capacity admixture flowmeters MES25/32/40mm or CMM25 or KMS25 Magnetic flowmeters sometimes are required to batch within the desired time cycle.

Admixtures come in many forms to obtain set results. Retarders, water reducers, mid-range water reducers and/or high-range water reducers, AEA air entraining agents etc. Consult your admixture supplier when mixing and sequencing admixtures. Mixing may cause admixture and concrete performance issues. Therefore consult your approved admixture technical representative.

Admixture Sequencing

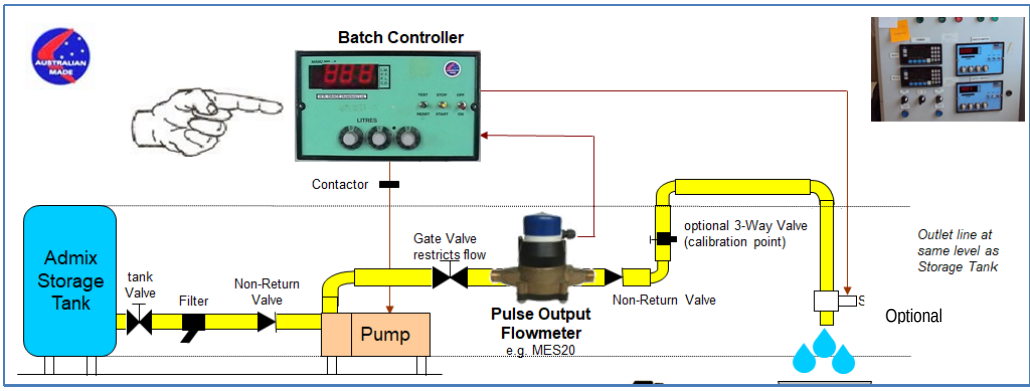
Sequencing of admixtures provides for optimal admixture performance. This means that different admixtures should be added to the concrete batching cycle at different times. In order to control the sequencing of admixtures, the concrete producer /batcher must by manual or via automated concrete batch plant PLC/computer sequence accordingly. Where ME2008 or ME995-MC2 PLC controlled plants operate, the PLC will stage the starts to the ManuFlo equipment which in turn starts the pumps/flowmeters for the admixtures and water etc.
Or in manual (non-computerized / PLC controlled) batch plants, the various ManuFlo ME995 batch controllers should be numbered so they can be started in best repetitive sequence. Where the ManuFlo ME995-7 water batch controllers are used with RPFS Paddlewheel or Magflow pulse flowmeters, the controller can be stopped to retain say 100 litres of water and then re-started for the tail water and final mixing. (The retain function can also be factored into the PLC program).



Admixture Group Discharge Sequence Requirements							
Discharge Line Location #	Air Entraining Agents **(a)**	Water Reducers **(b)**	Set Retarders **(c)**	Mid-Range Water Reducers **(d)**	High-Range Water Reducers **(d)**	All Other Products not listed on this row **(e)**	Set Accelerators and DCI Products **(f)**
1. Plant water discharge pipe	Discharge the AEA when the water starts to discharge.	Start discharge after all materials* are in the mixer but before the "tailend" water is discharged.	Directly after water reducer but before the "tail-end" water is discharged.	Directly after water reducer and/or set retarders but before the "tailend" water is discharged	Directly after water reducer, retarders and/ or MRWR but before the "tailend" water is discharged.	Directly after water reducer, type products but before set accelerators, DCI products and "tail-end" water enter the mix.	At the very end of mix cycle** after all other admixtures
2. Central or truck mixer		Start discharge after all materials* are in the mixer but before the "tailend" water is discharged.	Directly after water reducer but before the "tail-end" water is discharged.	Directly after water reducer and set retarders but before the "tailend" water is discharged.	Directly after water reducer, retarders and MRWR but before the "tailend" water is discharged.	Directly after water reducer, type products but before set accelerators, DCI products and "tail-end" water enter the mix.	At the very end of mix cycle** after all other admixtures.
3. Water-holding tank		Into the waterholding tank as the tank is filling and before the tank starts to discharge.	Into the waterholding tank after the water reducers and before the tank starts to	Into the waterholding tank after the water reducers and set retarders and before the tank starts to discharge.	Into the waterholding tank after the water reducers and set retarders and mid-range water reducers and before the tank		

* All materials means cement, other cementitious, sand, aggregate and initial water.
** This could be after the "tail-end" water enters the mix.

a)
Air Entraining Agents – Should be added up front in the batching process in order to allow air to build in the concrete.
b)
Water Reducers – Should be added after all dry materials and most of the water are added in the batching process.
c)
Set Retarder – Start the discharge of these admixtures immediately to follow the water reducer discharge.
d)
Mid-Range or High-Range Water Reducers – Start the discharge of these admixtures immediately to follow the water reducer and set retarder discharge.
e)
Other products: generally, start the discharge of these admixtures after the high-range, mid-range or water reducers
f)
Set Accelerators – sequence the discharge of these admixtures at the tail end of the batching process using larger diameter hoses and pumps, so discharge is fast finishing say 12 seconds before the end of the batching cycle.



ME995-6 with MES20 admix batch system

Discharge SOK at truck loading point

Disclaimer:
Manuflo has compiled the information in this document from its many years of experience, coupled with general respected industry sources and should only be considered as a guide only. Consult your chemical supplier for precise recommendations. (ATM 12/2019).